mcsSprinklers

Irrigation Control

Version 2.15

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1 Overview

mcsSprinklers is an integrated commercial / residential irrigation control package that uses readily-available personal computer resources or low powered dedicated computer to optimally irrigate an installation. It takes advantage of internet technology to obtain current environmental conditions as well as forecast data from which projected rainfall and evaporation is determined. It uses the Rain8 and EtherRain family of valve controllers to provide control via the existing power line, wired to the PC, or wireless. It also supports integration with Homeseer and xAP to augment the family of valves that can be controlled and further integration with other aspects of automation.

Irrigation control can be based upon calculated waterfall/evaporation, measured soil moisture, or three forms of periodic timed control. Mixtures of these modes can be used as well. Normal watering periods can be altered based upon current conditions such as wind speed, day-of-week, forecasted rainfall, and several other criteria to assure that water is applied only when needed and only when allowed by local regulations.

As well as the sophisticated automated modes of operation, it allows for several forms of manual intervention. Handheld remote control can be used to roam the irrigation zones and selectively turn on/off valves for head flow adjustments. Voice can be used to control zones and the current irrigation status can be vocally delivered with a voice request. Browser access from any internet location can also be used to manually control, observe status, or alter setup parameters.

mcsSprinklers maintains a record of all control actions taken from which utilization reports can be generated. It continually calculates soil moisture content based upon current environmental conditions and this combined with forecasted precipitation and sunlight is used to provide projections of future watering cycles.

Sprinkler valves are wired to automated valves such as the Rain8 modules in the same manner as valves are wired to traditional timed-controllers. This allows existing installations to be upgraded with a simple replacement of the old controller with automated Rain8 modules. Control via the power line or RF wireless yields minimum-effort solutions to retrofit existing installations.

1.1 Version Comparison

mcsSprinklers is available in three level of capability. The Basic Level Designed to perform manual and automatic timed control of up to 24 valves for all of the Rain8 family of modules. It's capabilities are approximately equivalent to a 24 program timed irrigation controller with the added benefit of desktop and internet access to provide for easy viewing and alterations of the schedules. It provides a rich user interface including graphical, touch screen and the ability for remote valve control with PDA or X10 palm pad.

The Standard Level is designed to achieve water cost savings and provide a rich set of control options. It takes into account weather conditions based upon internet data to both schedule when added moisture is needed and to not schedule due to wind and/or rainfall conditions. It provides visibility into historical valve activity and other parameters related to irrigation scheduling as well as all the features of mcsSprinklers Basic.

The Professional Level is designed for maximum customization and options. It supports active backup and email notification when attention is needed. Recordkeeping is enhanced with water use accounting and a more complete historical calendar. Additional control is available for liquid nutrient distribution (fertigation), use of moisture probes, and more flexible zone sequence control. Integration with other automation is provided with direct weather station interfaces, IP-based control, and xAP messaging. Support for the non-typical setups is provided in a unified manner that makes the complexity transparent. It includes all features available with the standard and basic version.

This manual describes the full capabilities of mcsSprinklers. Not all features described herein will be available with the Basic or Standard versions. It can be used as a guide to help understand what features are available in each version.

mcsSprinklers will configure itself based upon the license level and based upon responses provided in the setup interview. The intention is to minimize the complexity presented and only include features that are being used. Features that are tailored out of the setup screens based upon interview responses can be restored by using the “Expert Mode” setting on the Other Setup page. Features that are available with higher level versions can only be made available by licensing the higher level version. During the trial period the software can be configured for any of the three levels of capability so the level that contains the desired features can be evaluated.

Table 1 mcsSprinklers Version Comparison

Software Version	Basic	Standard	Professional
HARDWARE INTERFACE			
Host Platform	Windows XP,Vista,W7,WHS,+	Windows XP,Vista,W7,WHS,+	Windows XP,Vista,W7,WHS,+ Embedded ARM ArchLinux
PC Interface	Serial COM	Serial COM	Serial COM IP xAP
X10 Interface	ACK on Cmd	Ack on Cmd or Poll	Ack on Cmd or Poll Test Buttons Command Timing
Rain8Net and WiFi Master Interfaces	1	1	Multiple
Rain8 Net and WiFi	Itemize Units	Itemize Units	Itemize Units Search Command Timing Communication Test Command Buttons
Rain8 UPB	Yes, Itemize Units	Yes, Itemize Units	Yes, Itemize Units Communication Test Command Buttons
Rain8 X10	Yes	Yes	Yes
Rain8 X10-2	Yes	Yes	Yes
Rain8 Wireless	Yes	Yes	Yes
EtherRain	No	No	Yes
EPROM Programming	No	No	Yes

SCHEDULING

Control Strategy (Program)	Day of Week Even-Odd Interval	Day of Week Even-Odd Interval Calculated ET	Day of Week Even-Odd Interval, Moisture Probe Calculated ET
Zone Sequence Control	One Zone at a Time in user-entered order	One Zone at a Time in user-entered order	One Zone at a Time One Zone per Area Multiple Simultaneous Zones External Control
Run Styles	Zone-to-Zone	Zone-to-Zone	Zone-to-Zone Round Robin Inter-zone Delays
Program Modes	Automatic Manual	Automatic Manual	Automatic Manual Syringing
Program Start Times	24	24	24 per program Sunrise/Sunset Offset Variable Duration
Duration Resolution	1 second	1 second	1 second
Areas (Program Variants)	1	8	8
Month to Month Time Adjustments	No	No	Yes
Global Multi-zone program adjustments	By Month	By Month	By Month, By Percentage
Scheduling Restriction Setup	Day of Week Even-odd Days Between Hours	Day of Week, Even-odd Days Between Hours Wind Speed Temperature Rainfall	Day of Week Even-odd Days Between Hours Wind Speed Temperature Rainfall

			Rain Forecast	Rain Forecast ET External Discrete Inhibit Max Cycles Between Hours by Area Log Restriction
	Pump Control	Yes	Yes	Yes
	Water Flow Management	No	No	Multiple valve control to achieve optimal pressure
	Water Source Management	No	No	Discharge Rate Recharge Rate Budget Management Tank Management
	Fertigation Control	No	No	Yes
	Soil Moisture Determination	No	ET Calculation	Soil Efficiency Adjustment Crop Type Adjustment ET Calculation Moisture Sensor
	Evapotranspiration Calculation	No	Hourly Weather	Historical Hourly Weather Weather Station
	Internet-based Weather	No	AWS Weatherunderground NWS/EPA AccuWeather	AWS, Weatherunderground NWS/EPA AccuWeather
	Weather station-based Weather	No	No	Yes

USER INTERFACE			
Phone (Apple/Android)	No	Yes	Yes
Remote/Handheld Control	X10 Power line	X10 Power line RF	X10 Power line RF PDA IPhone/Android
Browser/Internet Access	Yes	Yes	Selectable HTTP port
Browser Style Customization	No	No	Yes
Graphical User Interface	Yes	Digital Pictures Calendar-based history	Digital Pictures Calendar-based history and status Current weather or other user-selected status devices
Touchscreen/Kiosk User Interface	600x800	600x800	600x800
Imperial and Metric Display Units	No	Yes	Yes
Control and Status Browser Views	Zone Status General Status Run Log Touch screen UI	Zone Status General Status Run Log Run Projection Touch screen UI	Zone Status General Status Run Log Run Projection Touch screen UI
Scripting Automation Interface	No	No	Yes

RECORDS and HISTORY

Wiring Color Record	Yes	Yes	Yes
Wire Harnesses	3	32	32
Zone, Area, and Site Digital Pictures	No	Yes	Yes
Water Use Accounting	No	No	Measured Calculated
Soil Moisture Trends	No	Yes	Yes
Valve Activation Logging	No	Yes	Yes
Number of Loadable Configurations	Unlimited	Unlimited	Unlimited Scheduled
Historical Database	No	MS Access	MS Access SQL Server My SQL SQLite
Historical Calendar	No	Weather Items, Soil Moisture Level Runtime	Weather Items, Soil Moisture Level Runtime Water Use Fertigation
Annual Trend Charts	No	Yes	Yes
Daily Detail Statistics	No	Yes	Yes

SAFETY and BACKUP			
Redundancy / Hot Backup	No	No	Self-Monitored Multiple PCs
Min and Max Safety Intervals	No	No	Yes
Communication retry and failure recovery	Yes	Yes	Yes
Internet Login Authentication	Yes	Yes	Yes
Email Notification	No	No	Yes

1.2 Acknowledgements

Version 1 of mcsSprinklers was introduced in 2003 into the Homeseer community. Many users provided valuable feedback to improve the usability of mcsSprinklers. Of particular value was the diversity of the needs and the operation in international locations. While all deserve acknowledgement, the memory of the early days is not complete. A partial accounting is Bkphillips (Anaheim, CA), Cecil, DC, Degabe (Loomis, CA), Droopyear (Szekesfehervar, Hungary), Frobnitz (France), JB Coulter (Visalia, CA), Jmonaco (Rocklink CA), ka7gzr (Kent, WA), Mario from Spain (Madrid, Spain), Mountainman (CO, USA), Pete (Lockport, IL), Smoothtlk (Metamora, MI), uberseer (Sugar Land, TX)

Version 2 of mcsSprinklers was introduced in 2005 with a mixture of Standalone and Homeseer users providing ideas and assistance in making mcsSprinklers more user-friendly and feature rich. Version 2.6's new features are primarily the result of user suggestions and effort in assisting the incorporation. Scott Bunker, Castle Rock, CO provided WeatherUnderground as an optional source of Internet-based weather data as well as the Calendar popups. John Bonzey, Auburn, MA provided the handheld/Palm method of remote control. Doug Behl, Nevada City, CA for the large site considerations such as the popup pictures and area naming.

Some software components utilized within mcsSprinklers were obtained from internet sources. The tooltip capability for context help was provided by Erik Bosrup's overLIB. The graphical sliders were obtained from Erik Arvidsson. Graphic icons were adapted from various sources including user contributions on the Homeseer message board. The email facility was adapted from code posted by Gregg Housh.

2 System Architecture

The system architecture uses a modular and incremental structure that leverages modern computing technology, Internet, and low-cost interface electronics. The architecture is scalable from a single value residence controller to a very large commercial controller. It can operate within an existing small personal computer to minimize cost or run as a network of computers to maximize reliability.

The personal computer provides a dramatic improvement in the user interface in the operation of a sprinkler controller vs. dedicated controllers. The use of the Internet also provides a dramatic improvement in the efficiency of commercial and residential irrigation.

The two primary components to the irrigation controller are the electronic control of the sprinkler zone valves and the optimal scheduling of water distribution. Small Rain8 modules perform the electronic control. Each of these can control eight watering zones with wiring from the zone valve to the Rain8 module being the same as the wiring to traditional timed controllers.

The watering schedule is determined on the PC and this schedule is conveyed to the Rain8 modules in one of three mechanisms. This can be with a direct cable connection, an interface using existing house wiring, or a wireless radio frequency interface. The scheduling is setup by the user with a rich interactive interface and is augmented with real-time information about environmental conditions from the Internet.

This basic architecture is augmented with the ability to monitor local conditions with sensors such as a water flow meter, manually control the zones with a handheld remote or voice, add redundant components to accommodate unexpected failures, and use the Internet for off-site control and monitoring.

This architecture is pictorialized in Figure 1 System Architecture.

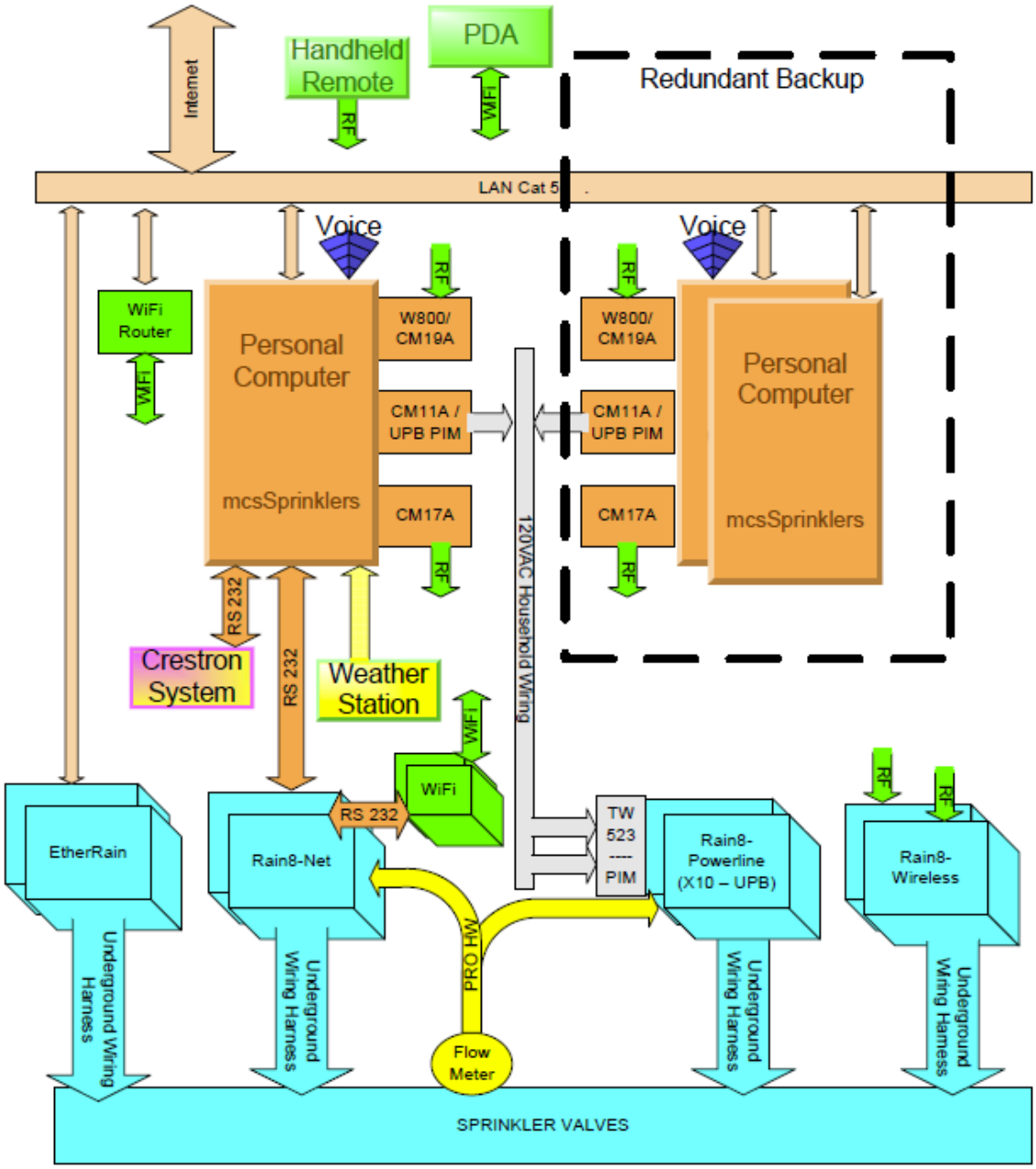


Figure 1 System Architecture

2.1 Controller Selection

The selection of a controller will depend primarily upon the means of physical connection that is most viable for a particular site. There are advantages and disadvantages with each option available.

Powerline connections are typically the easiest to retrofit since the powerline connection will be available at many locations. The powerline is shared for many uses and the potential exists that interference with communication can exists using the same shared wiring. X10 and UPB interfaces to the powerline are available. The X10 is lower cost and the UPB is more robust. In the X10 case there are two models. One provides a communication path to command a valve while the other provides both command and status.

The status is used to assure the command was received. The UPB provides both command and status. The Rain8UPB also provides a counter input that can be used to measure water use if a digital meter is available at the site.

At some locations a LAN is prewired and this makes for a very robust connection and is the most desired one from a reliability perspective. The EtherRain and Rain8Net via an IP/Serial adapter can be used in this environment. Variations of this are WiFi where the wired LAN is bridged with RF to allow communications over the air in a range of around 50 ft. The Rain8Net provides a counter input for water use measurements and allows each of the eight valves in the module to be independently used for zone valve, fertigation valve, and pump valve control. The EtherRain is able to only able to activate one of the eight zone valves at a time, cannot be used for fertigation valves, and pump control needs to be managed with the 7/1 variant of the EtherRain. These control restrictions affect the ability to run multiple zones in parallel to manage water flow rates.

The Rain8Net can also be used with a direct RS-232 wired connection between the computer and the controller. Since it is a dedicated wire it has good communication reliability. When the computer and the controller are in the same proximity then the addition of the direct wiring may not be burdensome. Consideration is also needed for the ability of the computer to support a RS-232 interface as many modern ones only support USB. If USB/RS-232 adapters are used care should be used to select ones that have good software driver support for the operation system to assure reliable communication.

3 Installation

3.1 Standalone

3.1.1 Windows PC Host

The installation is performed with execution of the downloaded setup.exe or setup_service.exe program. When either is run it will create a folder and install all necessary components under this folder. The default install location is C:\Program Files\mcsSprinklers for the standalone version or C:\Program Files\Homeseer PRO for the Homeseer plug-in version.

For the standalone install a tray icon is available to provide a quick user interface to mcsSprinklers. See Figure 2. For the non-service install this tray icon is required and it is optional for the service install. It is normally the case that the tray icon interface is started when the user logs into the computer. This can be automated by placing a shortcut to mcsSprinklers_Tray.exe in the user's startup folder.

Following a service install the computer will be setup to automatically start the service when the computer starts. The service will not be running immediately after the install. It can be started by restarting the computer or by starting the mcsSprinklers service. While different versions of Windows have different ways to manage services, the following for WHS will be similar on others. Right-click Computer, Manage Computer, Services and Applications, Services, Right-click mcsSprinklers, Start.

When the mcsSprinklers service is started or when it is stopped an entry will be made in the Windows Event Log under the Application events. mcsSprinklers does not use the Windows Event Log for any other purpose. Events reported by mcsSprinklers will be local via browser on the Messages Page and available in text file in subfolder C:\Program Files\mcsSprinklers\HTML\mcsSprinklers\Data\StartupTrace.txt.

To install the tray icon on individual user login the file mcsSprinklers_Tray.exe should have a shortcut placed in the user's startup folder. This folder can be reached with Right-click on Start button, Explore, Programs, Startup. mcsSprinklers_Tray.exe will be in C:\Program Files\mcsSprinklers folder if a default install is performed. Rather than placing the icon in an individual user's startup folder it can be place in the All Users folder so it will be available to all users upon their login.

When running on Windows version starting with Vista enhanced security needs to be considered. mcsSprinklers must be "run as administrator" since it communicates with hardware resources. When User Access Control (UAC) is enabled then a user prompt will be presented to confirm startup intent with the additional privileges. This prompt is usually not desirable, especially with unattended restarts. This can be overcome with a shortcut that enables elevated operation. A tutorial is provided at http://www.sevenforums.com/tutorials/11949-elevated-program-shortcut-without-uac-prompt-create.html An extract from this location is embedded at the end of this manual.

mcsSprinklers_Tray.exe can also be placed to run on any computer on the LAN to gain access to mcsSprinklers that is installed as a service. For this situation the tray option for "Tray Setup" should be used to change the address of where mcsSprinklers service is running. The default is the local computer, but can be changed to any computer name or IP address where mcsSprinklers service is running. The port selected on this setup needs to be the same as the used by the mcsSprinklers service. The default is 8008, but can be changed as part of the mcsSprinklers setup. Select the "Tray Setup" option again from the tray to close the setup form.

When remote access to the computer either through the LAN or WAN is desired then the firewall on the computer where mcsSprinklers is installed needs to setup to allow mcsSprinklers passage. This is true for the remote tray icon or remote browser use in general.

The mcsSprinklers Tray will monitor the execution of mcsSprinklers when either locally or remotely referenced. Should it loose contact it will provide this indication with a popup balloon.

When mcsSprinklers is running as a service the Tray setup should be configured to Inhibit mcsSprinklers Launch Control. This will make the "Launch" option unavailable from the tray icon. When mcsSprinklers is installed as a desktop application rather than as a service then the tray icon can be used to control the execution of mcsSprinklers. In a normal setup the shortcut to mcsSprinklers_Tray.exe will be placed in the startup folder and the tray launch control will be set to Auto start mcsSprinklers when the tray icon is started. This Auto start can be defeated with the "Manual" selection for launch control. Execution start and stop then will be through user action of the tray icon options.

When the tray is available it will be used to provide event message notification. When an event that warrants user attention is raised then the tray icon will change color to amber. It will also change color to green when at least one irrigation zone is running. For events a popup will appear for 20 seconds or until the mouse is used to acknowledge it. The Message Page is shown to display the events in a static format. Once the event is acknowledged the tray icon will change back to the blue or green color within sixty seconds unless further events are reported.

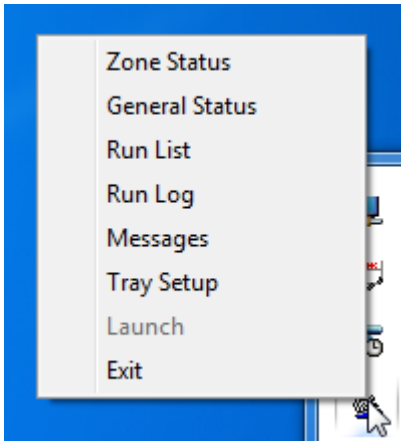


Figure 2 Desktop Tray Access to Status Pages

For a basic installation this is all that is required. For a distributed installation there are six applications that are available in the standalone version to be run on any computer on the local network. During execution of the setup.exe program checkbox options are available to select individual components. The setup.exe can be run on each remote computer and the desired components installed at that location. Table 2 provides the list of functions that are available for distributed execution.

Table 2 Software Interface Modules

Interface Component	Description
xapmcsCM17A	PC interface to control one or more Rain8-Wireless modules
xapmcsCM11A	PC interface to control one or more Rain8-Power line modules
xapmcsRain8Net	PC interface to control one or more Rain8Net modules
xapmcsUPB	PC interface to control one or more Rain8UPB modules
xapmcsW800	PC interface to accept handheld remote control inputs from W8800
xapmcsCM19A	PC interface to accept handheld remote control inputs from CM19A
xapmcsVoice	PC interface to accept voice commands and speak status
xapmcsWeatherAWS	PC internet interface to obtain current weather conditions
xapmcsWeatherXML	PC internet interface to obtain forecasted weather from Weather.com

xapmcsHub	Traffic router for applications on same PC

3.1.2 Embedded Platform

The embedded platform comes with mcsSprinklers and associated operating system files preinstalled on a USB flash drive. This drive is inserted into any USB port on the platform. A network cable and power cable are inserted into their appropriate jacks.

After a short delay the status light on the front will start blinking and within 30 seconds after it stops mcsSprinklers will be ready to accept requests from a browser. The network node name will be mcsSprinklers and the IP address will be provided by the DHCP server on the LAN. This means there needs to be a DHCP server and this is normally the router that provide access to the internet.

The default port is 8008 and the IP is available from the DHCP server (router) or from the ARP table. The ARP table can be viewed from a command prompt (run cmd from Windows Start) with the command "arp –a". Use the MAC address printed on the bottom of the embedded platform to identify the specific IP associated with that address. Any valid mcsSprinklers page can be used as the initial routing will be to the registration page. For example, http://192.168.0.101:8008/status would be a browser URL to get initial access to the embedded mcsSprinklers if the DHCP server assigned 192.168.0.101 as the IP address.

3.2 Homeseer

For the Homeseer install the Homeseer Updater is used to assist in the installation. In this case care must be exercised to assure that the install is placed in the correct folder where Homeseer is running as different versions of Homeseer run in different folders. The menu items available in the standalone tray icon are available from the Homeseer menu where the Homeseer log is displayed.

When installation is performed on a Homeseer PRO-100 or similar processor then one needs to be aware that the C drive, where the system files are stored needs to be explicitly unlocked to allow files to be saved to this drive and this unlocking operation needs to occur prior to installing mcsSprinklers. After installation it can be write-protected again. If this step is not performed then the install will not persist during a power cycle of the PRO-100 or Hometroller.

3.3 Registration

mcsSprinklers is licensed to run on one computer. It will operate on a trial basis for 30 (Homeseer) or 45 days (Standalone) and after that time it will no longer startup until registration is performed. The registration process will depend on whether mcsSprinklers is run standalone or as a plug-in to Homeseer.

3.3.1 Standalone

mcsSprinklers provides a user interface via a web browser. The browser can be launched from a user desktop or Start menu and the URL completed to reference mcsSprinklers or it can be done from the mcsSprinklers tray icon if it is installed. See Figure 2. The default URL for registration is "http://localhost:8008/registration" with the browser launched from the same computer as the installed mcsSprinklers. This default can later be changed as part of the setup. Any status page request from the tray icon will also result in a registration page if registration has not been completed.

Until registration is completed the only page that is avaialble from mcsSprinklers is the registration page so all other page requests will redirect to the registration page. The blank registration page is shown in Figure 3. Registration can be performed directly with the product serial number supplied with the purchased software. It can also be done by contacting customer service and providing proof of purchase information, Computer ID and Disk ID to obtain an unlock code.

Contact information of your choosing (e.g. name) can be entered so that customer support can identify you in the case that you misplace the registration information and the software is to be installed on another computer.

The zip code may also be entered at this time so that the proper environmental conditions can be setup or it may be entered later in the mcsSprinklers setup process on the “Others” setup page.

The registration information entered on the registration form is submitted using the “Register Now” button at the bottom of the form. This will transfer the information to the internet address identified as the Registration URL where it will be validated and retained for permanent records. No other information, except that shown on the form is transferred to this site.

On the embedded platform the registration page also contains settings to identify the time zone and the network setup. The network should be setup before attempting to register since mcsSprinklers needs access to the internet to perform the registration. To get access to the registration page from a browser there needs to be a DHCP server on the LAN to assign an IP address. The embedded computer network name is mcsSprinklers. If the embedded platform has wWiFi capability then the setup for the wireless network will also be shown otherwise only a wired network setup will be available.

Registration V2.11.0.9/2.11.0.45 (Professional) Copyright 2004-2011 mcsSolutions - Microsoft Inter...
File Edit View Favorites Tools Help
Back Search Favorites
Address http://192.168.0.134:8008/registration
Go Links McAfee
Registration V2.11.0.9/2.11.0.45 (Professional) Copyright 2004-2011
mcsSolutions
08/13/2011 6:45 PM Sunrise: 4:02 AM Sunset: 5:55 PM
Setup Interview | Rain8 Setup | Wiring Setup | Layout Setup | Zones Setup | Areas Setup
Programs Setup | Site Setup | Weather Setup | Remote Setup | Other Setup | Picture Entry | xAP Reporting
Help | Zones Status | General Status | Run List | Run Log | Touch Zone | Touch Area | Serial IO | Messages
Local Pollen Reports | Airport Conditions | Lawn and Garden Weather | Rush Hour Traffic
A registration code is needed to unlock the software. The software will function for only 45 days without registration. This code is obtained over the internet when the "Register" button is clicked. This registration will generate a unique unlock code based upon identification of the hardware.
The software will only run on the computer on which it was registered. If this is not the computer which is intended to run, then it should be uninstalled and reinstalled on the desired computer.
The registration will also send the encrypted unlock code, encryption key, and software serial number over the internet. Only information displayed on this form will be transmitted during the registration process. The encrypted information will be used to assure that future attempts to register with the same license on another computer will not be successful. The serial number will be used to identify you should it be necessary to reset the registration to allow you to reinstall or move the software. The contact information is optional and is only used in the case you should loose your registration codes and you desire to contact customer support for assistance in finding the code.
Now Running as Fully Registered
Network ID = 00253101CA32
Serial Number received with software XXXX-XXXX-XXXX-XXXX-XPRO
Zip code to identify general environmental conditions 98045
Contact Information to retieve regstration information in case it is lost
Update Registration
Local Time Zone America/Los_Angeles
Wired Network Setup
IP Type Static
IP 192.168.0.134
Gateway 192.168.0.1
Mask 255.255.255.0
Wireless Network Setup
IP Type DHCP
IP
Mask
Mode OPEN
Encryption NONE
SSID default
WPAPSK
Key ID
Key
Update Network Settings
Computer Restart Likely Required for Network Changes to Take Effect
Done
Internet

Figure 3 Standalone Registration Page

3.3.2 Homeseer Plug-in

When used as a Homeseer plugin, the registration process is managed by Homeseer Technologies (http://www.homeseer.com).

Three plugins are available and only one of these can be enabled. The plugin is a function of the license obtained and will be mcsSprinklersB (Basic), mcsSprinklersS (Standard) or mcsSprinklersP (Professional). The process is normally started by downloading the mcsSprinklers plug-in using the Homeseer updater. After the download is complete the Setup tab and then the Interfaces tab is selected to view the list of available plugins. The plugin will require either a registration key from Homeseer Technologies or can be activated using the Trial button. Once the trial button is selected, the enable link is activated. You may the click the grayed Enable button. The selection is then saved with the Save button. An enabled configuration setup for the Basic version is shown in Figure 4.

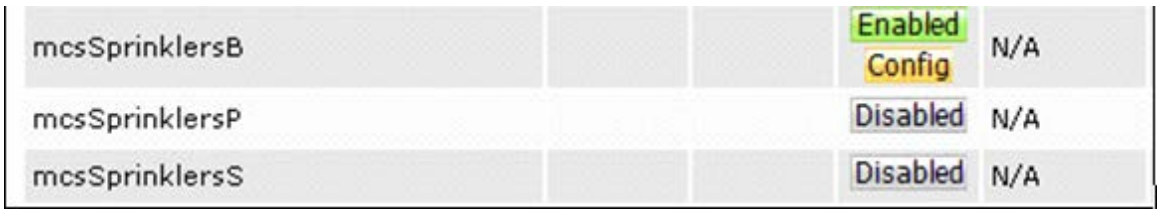


Figure 4 Homeseer Licensing of mcsSprinklers

3.4 Startup

Following validation of the registration or the trial, mcsSprinklers will initiate its startup initialization. During this time it provides significant checks to assure data is consistent. While checking and when not running as a service it will show a splash screen such as Figure 5. At the bottom of the screen will be a progress bar that shows its relative progress and segment it is processing.

Figure 5 Startup Splash Screen

Following this check there will be a short delay while Windows manages its resources. Startup is complete when the mcsSprinklers icon appears in the Windows tray at the bottom right of the screen.

When performing setup operations mcsSprinklers looks for unexpected behaviors. Since it does not want to save a potentially corrupt setup it will not save changes made while errors are detected. The message log or the General Debug output file will provide further information about detected inconsistencies.

3.5 Initial Setup

3.5.1 Visual User Interface

The setup for various scenarios is shown by example in the remaining paragraphs of this section. Once the setup is complete the user has the option of visibility of finest details maintained by mcsSprinklers via the General Status, Zone Status and Run List pages. These views provide the visibility when needed, but for general operations for the majority of users the visual user interface will be the most frequently used view (Figure 6).

Figure 6 Visual User Interface

Each zone is identified by name and visually by photograph. The large arrows at the top scroll the zones until the desired zone is positioned in the center location with the black border. The selection can also be accomplished directly with a mouse click by clicking one of the dots below the photographs. These dots are in positional order and each represents a zone. They are colorized to identify when they are running (green), are disabled (yellow), have failed (red), and not currently running(blue).

When the mouse is placed over a zone status dot the rightmost picture will be replaced with the picture of the zone where the mouse is positioned. This allows the row of dots to be scanned to find the desired zone and then clicked to have the picture move to the center and it will then be the selected zone.

When the mouse is placed over the selected (middle) picture then the leftmost picture will change to a picture of the area in which the zone is located. This allows a context to be identified easily for larger installations. When the mouse moves away from the center selected zone picture then the prior zone picture will be restored.

When a zone is selected, adjustments to the settings for the zone can be made with the slider controls. These sliders will change the setup information on the Zone Setup and Area Setup pages. Either this graphical control or the setup pages can be used to accomplish the same changes. A more detailed setup with more options is available from the setup pages.

The scheduled irrigation program is the "Auto Program". This program will be run based upon the control strategy setup in the Area Page. One of the auto program parameters is the duration that a zone will run. There are actually three parameters that determine the actual run time of a zone. One is the Zone time, one is the Area time, and the third is the Site time adjustment. The Zone time is the nominal time that a zone will run at the peak of the irrigation season. To account for seasonal variations an Area time factor is applied to this base Zone time. For example, in October the duration may be reduced by 30% from the nominal July duration. A Site adjustment is also applied to allow all times to be adjusted upward or downward by the same percentage.

The touch screen interface provides access to the Zone time adjustment in the Auto Program column. The slider changes the Zone time with the number being shown actually being the composite of the Zone time, Area factor, and Site factor. For example if the Site adjustment is +10% and the Area factor is 70% and the nominal Zone time is 50 minutes, then the slider will show (50 * .70 * 1.10) 39 minutes. If the slider is adjusted to 20 minutes then the nominal Zone time will change to (20 / .70 / 1.1) 14 minutes. After changing the Auto Program slider to 20 in this example, then going to the Zone Setup page one will see a value of 14 for the Zone Auto program time. The number that is seen on the slider is the number of minutes that the zone will actually run based upon the other setup information.

There is also a slider under the Manual Program column. This slider is used to change the timeout duration for a zone when the zone is controlled manually. Manual control can be with a handheld device or from the browser. The time set for the manual duration timeout has no effect on the auto program times. If the manual time is set to zero then the zone cannot be manually controlled.

A control button is provided under the Manual Program slider. This button toggles between Run and Stop. When the Run button is activated then the manual program for that zone will be started. It will run the zone until the zone is stopped or until the manual program duration timeout is exceeded. When the button shows "Stop" then it will stop the currently active program for the zone. This means the zone could have been started manually or automatically and the same button is used to stop that zone from continuing.

Rather than stopping a zone it is also possible to pause the current program so that it can be resumed a short time later. That is done by using the "Pause" button. When selected, this button will toggle to read "Resume". When "Resume" is selected then the current program will continue from the point it was paused.

Next to the Pause/Resume button is the "Skip" button. This button is used to skip all zones in tomorrow's auto program. In essence it tells mcsSprinklers to not automatically run any zones even if they were scheduled for tomorrow. When the Skip is active then the button will change to "Allow" and the decision to not irrigate tomorrow can be rescinded.

There is a slider under the Current Status column. The value showing on this slider represents the percentage of soil moisture saturation. mcsSprinklers keeps track of the soil moisture content based upon weather information and the irrigation performed. When the control strategy is setup on the Area page to be one of the timed modes then soil moisture content is only informational and changing it with the slider has no direct effect. When the control strategy is based upon calculated soil moisture then a change of the slider will have a direct effect on the next irrigation time for the zone.

The next scheduled times for the currently selected zone as well as the time that the next scheduled zone will be run are shown under the area labeled “Next Schedule”. As the schedule changes or as zone completes its cycle the status information is updated to reflect the most current information. When the mouse is positioned over the “Auto Program” label at the lower right of the page a popup will appear that occupies most of the screen. This will show the full program with the zones listed in the order that will be run. The current soil moisture levels are also shown on this popup.

The screen updates are performed immediately upon user control of the buttons or sliders. It is updated a few times per minute as the irrigation schedule progresses. There are occasions where a browser looses sync with its server and the updates will stop. There is a small double arrow icon in the upper left of the page that can be used to refresh the screen to assure the information presented is the most current.

The currently active zone will automatically be shown as the selected zone when that zone starts its cycle. The status dots will update, as will the slider information about the selected zone without the need for a page refresh. The same is true for the Next Schedule information as it changes.

The current time and weather information is shown in the Current Status area. This information is updated as new weather data becomes available. The clock runs continually. The temperature and wind speed buttons can be selected to popup an annual trend chart showing either the temperature or wind speed trends. This annual information is available for all weather data and zone valve control information when accessed from the calendar from either the General Status or Zone Status pages.

The “Time Remaining” display at the center of the screen shows the number of minutes that are remaining to be run for all zones that are currently scheduled to run at the current time. It is updated each minute as the time counts down.

A three or four week window into the selected zone’s activity is shown in the lower left. The calendar shows each day the zone was run with a green sprinkler graphic and each day it had rained with a blue raindrop graphic. The weather forecast is shown for the next week and a blue sprinkler graphic positioned in the day of the next scheduled irrigation for the zone. A mouse click on a cell in the calendar will popup more detailed information about that day.

The two small icons are at the top right and left of the page are navigation controls. The refresh icons were previously described to refresh the current display’s information. The icon on the upper right is used to get access to the other mcsSprinklers pages. From these pages additional setup can be done or more detailed status information gathered.

The top of graphical display contains three panels that will show different information based upon where the cursor is hovering on the screen. Figure 7 shows the three views. In all views the center panel shows the currently selected zone. The selected zone is the one where the remainder of the screen shows information and allows settings for this zone to be changed.

The top view is default view when the cursor is not positioned in a critical area. It provides the time of day and up to six current measurements. The measurements to be shown are user-selected from the General Status page.

The middle view is shown when the cursor is positioned over a colored dot (Figure 6). These dots are located immediately below the three panels. Each dot corresponds to a zone. The current setup for the zone is shown in the left panel. The right panel shows a picture of the zone.

The bottom view is shown when the cursor is positioned over the left or right scrolling arrows. It shows the picture of the zones that will move to the center panel position with a click of the right or left arrow button.

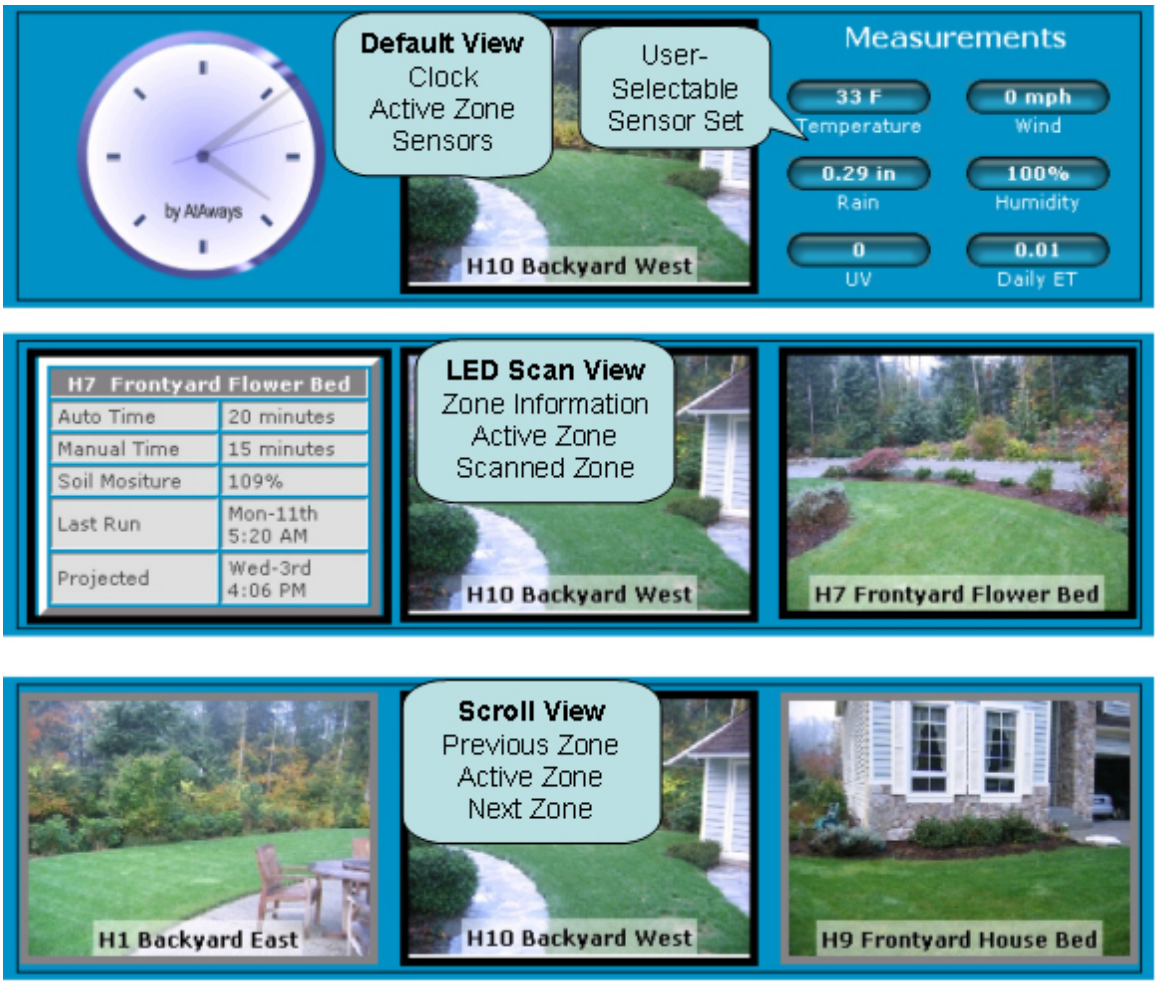


Figure 7 Views Available from Graphical UI

3.5.2 Quick Start – Learn by Example

When mcsSprinklers is started it will place itself as a small icon in the lower right tray of the PC desktop. The icon will be a blue or green base with water drops rising. Blue indicates that no zones are currently being watered and green when any zone is active. When the icon is clicked it will expand to show a menu of setup and operational selections. When used as a Homeseer plug-in then this icon is not available, but access is provided through the Homeseer menu.

The general setup flow is numerically identified in the popup menu. In some cases there is a dependency on the setup sequence, but in general any setup page can be edited at any time and in any order. The dependencies that exist relate to identification of a valve interface before the valve can be wired and the identification of how the valve is wired before it can be used in a control zone. This means that the Rain8/Devices setup needs to be done before the Wiring setup and the Wiring setup done before the Zone and Area setups.

A browser interface is used for each setup and control page. This means that the setup can be done from any location to which the PC has network connectivity. It also means that entries made on a page are not recognized until the “Save” button on top of each page is clicked and the screen redrawn.

Navigation among the various pages can be done from the tray icon / menu or it can be done from the links located at the top of each browser page.

To illustrate the basic setup flow a few scenarios will be used to base the setup actions. The first will be a minimal setup of one zone to be watered for 30 minutes every other day. Two other scenarios will be shown to illustrate some of the setup features.

Some of these scenarios are available as preconfigured setups that can be selected as the first item in the Setup Interview. The interview is selected from the tray icon.

3.5.3 Sample Scenarios

3.5.3.1 Scenario 1 – One Zone Setup

A Rain8-Wireless unit is being used to control a single zone on a schedule of 30 minutes every other day. The computer has a CM17A/Firecracker installed on Com Port 1 to control the Rain8-Wireless.

Select **Setup1-Rain8. Choose Rain8-Wireless** to identify that the Rain8-Wireless is being used. It comes from the factory programmed as Unit B1 with timeout of 60 minutes in each zone. This is adequate for use in this scenario. If it were not then the Timer setup at the bottom of the page would be used to configure it as desired.

Enter 1 in the Module PC Interface group, Wireless port box to configure the CM17A/Firecracker to use port 1.
Click the radio button at the intersection of house row B and bank 1 to select the Wireless module type. This means that the module's valves will be associated with addresses B1 through B8. Click Save button at the top to record these settings.

Select **Setup2-Wiring.** To identify the wire connection between the valve and the Rain8 module,. let us assume that the valve is connected to the Red wire and we will be using the second position on the module (B2) for this valve. The first column's pull down is selected to be RF B2. The second column contains a box to label this valve. Let us call it Lawn and enter this name in the box. Click the Save button.

At this point the Rain8 interface has been defined and the wiring to the valve located in the Lawn has been specified. The next step is to describe when to turn the valve on. The next step is on the **Setup4-Zone** page where the duration of 30 minutes is identified. There are twelve rows in the Area 1 group and any of these rows can be used. Select the pull down to pick the RF B2 Lawn valve. Enter 30 in the Auto minutes box. Click the Save Button.

Select **Setup5-Area. A** setup page for the areas will appear. We will use the Area 1 for this scenario. Click the radio button at the top for this area that identifies it to be an interval strategy. It is one of the five possible selections. Enter 2 in the box below it since the interval is every other day or 2.

This completes the setup for the scenario of a single value using a Rain8 Wireless controller that is scheduled for watering for 30 minutes every other day. The zone will be watered starting at midnight every other day.

3.5.3.2 Scenario 2 – Basic Homeseer Setup of Two Sprinkler Valves

mcsSprinklers is added to an existing Homeseer configuration where the sprinkler valve interface is the Homeseer X10 interface or virtual devices through other Homeseer plugin. A relay mapped to [1 and an appliance module at M16 will be used to control sprinkler valves. The valves are to be activated for 40 minutes each on Monday, Wednesday, and Friday and not allowed to be run between 10:00 AM and 4:15 PM

Select **Setup1-Devices.** To identify the devices that are being used, in the section titled "Homeseer X10-IO Devices" enter [1,M16 in the text box. Note the comma to separate the two virtual devices. No entries need to be made on any other boxes on this page since the control interface to the hardware is via Homeseer.

Click Save button at top to record these settings.

Select **Setup2-Wiring. T**o identify the wire connection between the valves and the devices let us assume that the valves are connected to the Red and Blue wires in the wiring harness. Select the row where the wire color is red and from the pull down select [1. In the Location column give it a name. This name will be used to set the name of the Homeseer device.

Click Save button at top to record these settings.

Select **Setup4-Zone.** Since both valves are on the same M/W/F schedule they can be placed in the same zone. In the valve column select two rows and each valve. In the Auto Minutes column enter 40 for both since that is the duration the zone will be run each time it is activated. Soil Efficiency and Rain Factor will contain default values that do not need to be changed. They are used for control modes based on soil moisture content.

Click Save button at top to record these settings.

Select **Setup5-Area. A** setup for one area will be presented. It will show the zones associated with the area at the top and the 30/7 day history for the zone. The history will initially be blank. The M/W/F schedule is selected by clicking the "Day-of-Week" radio button and the check boxes for Monday, Wednesday, and Friday.

No specific start time is needed so the Area start times need no entry. No pump is specified so no entry is needed in this section either.

Click Save button at top to record these settings.

Select **Setup6-Restrictions.** A variety of restrictions can be imposed. In this case the desired restriction is entered into the "Don't between hours" with values of 10:00 and 16:15

Click Save button at top to record these settings.

Select **Setup9-Other Setup.** The browser interface to mcsSprinklers can be serviced by the plug-in or by the Homeseer server. Select the desired radio button.

Real time weather data and forecasted weather as well as nominal seasonal percentages are based upon the zip code. Enter the zip code and click the Save button. The screen will be redrawn and available local weather site will be presented in the Time and Weather Setup section. Select at minimum, the primary site and backup sites if desired.

Near the bottom of the page are some setup options specific to Homeseer. The device codes shown for Manual mode and Seasonal control are moding devices. One toggles between manual and automatic modes and the other toggles between plug-in Enabled and Disabled. The display options relate to how the Homeseer Device Strings are formatted and the overall appearance of the browser page. The Database option allows selection of Microsoft Access vs. SQL Server for retention of historical information.

3.5.3.3 Scenario 3 - Replacement for Stand-alone Timer

A standard timer normally used for timed control of sprinkler zones is being removed and replaced with a Rain8 to achieve computer control of the sprinkler zones. The following objectives are to be satisfied:

1. 4 Zones are being controlled
2. Rain8-Net used for valve control
3. Watering scheduled for Monday, Wednesday and Friday for Lawn areas and daily for garden
4. Two lawn zones to be watered for 60 minutes, one for 30 minutes and the garden for 20 minutes
5. Watering cycle to start at 2:15 AM for the lawn and 1 hour after sunrise for the garden
6. Garden water is supplied by a pump while the others by city water
7. Com port 2 is available on the PC

The setup flow is the same as with scenario 1 starting with the Rain8 interface, its wiring, the control strategy for the areas, and the durations for the zones.

Setup1-Rain8. The Rain8-Net module needs an address. Since only one is being used, we can search to find it, or we can just program a specific address. In this case we will set it to 1 and then search to confirm. The first step is to remove the Rain8 module from connection to any valves. The programming of the unit cannot be done in an "installed" configuration. All programming is done from entries made in the EPROM Timers group at the bottom of the Setup1-Rain8 page. The programming port number is selected to identify the serial connection to the PC. The module type radio button is selected to be Rain8-Net. The address box entry is 1. The timeout/safety times will be set to 80 in this scenario since it is a reasonable value above the maximum time of 60 minutes that is planned. After all entries are made then the Write EPROM button is clicked. This will reprogram the connected module. After a few seconds the Read EPROM button can be clicked to read back the current settings to confirm that the proper settings were applied. The module can be removed from the programming port now and connected to the port that will be used for normal operation. These may be the same ports and in this case no move is required.

At this point we know the Rain8 module's address is 1 so we can do a search and know what to expect. The search is done from the top of this same page. First the Rain8-Net interface port is identified to be 2 in the Interface group. This is the port that will be used to communicate with the Rain8-Net in a normal operational setup. The second group on the page contains two buttons. The rightmost one is clicked to start the search. The page will be redrawn with a window between the two buttons. A value will increment in this window to show the current address that is being searched for Rain8-Net modules. In this case we do not expect any after 1, so when a number greater than 1 appears the rightmost button can again be clicked to stop the search.

At this point the Rain8-Net module has been setup to interface to the valves.

Setup2-Wiring. Four valves are being connected so four wires will need to be identified to mark which wire is connected to which valve. A pump is being controlled so a fifth wire is also needed. If they are in the same harness then all can be specified in the Harness 1 group. Use the pull down on each row to make the linkage between water valve, wire color, and Rain8-Net valve control. The pull down will show NET 1 Valve 1 through 8 since that is what was previously identified. Each valve is given a name in the boxes on the rows. Let us use Front Yard, Back Yard, Flower Bed, and Garden. The pump will be called Pump.

Setup4-Zone. The four zones are organized into two areas per the setup that was done for the Area control times. The three lawn valves are identified with pull-downs in the Area 1 zone group and Auto times entered as 60, 60, and 30 in the three identified rows.

In the Area 2 Zones a single row will be selected to identify the garden valve and enter the 20-minute cycle.

The manual times for each of the 4 zones will also be entered with the same values so manual control of each zone can be done.

Setup5-Area. The lawn requires a M-W-F schedule while the garden requires a daily one. This implies that two areas need to be defined. The first will be for the lawn zones. The control strategy is selected to be Day-of-Week with the radio button at the top. The Monday, Wednesday, and Friday checkbox are checked. Watering is to start at two hours 15 minutes before sunrise, so -2:15 is entered into Time1 box with a relative to sunrise selection.

In Area2 the Interval radio button is selected and a value of 1 for the interval. The entry in the Time1 box will be 1 and the radio button checked to the time will be relative to sunrise. This area has a pump so the pull down is used to identify the wire connected to the pump.

Setup8-Weather. Since the time specified for the garden is relative to sunrise there needs to be location information entered so mcsSprinklers can computer sunrise and sunset times. This is done from the Setup8-Weather page with an entry in the Zip Code box. Since weather information is not needed the Internet download method can be set to Don't Download Weather and Forecast Data.

3.5.3.4 Scenario 4 - Typical Use of Features

A typical scenario will go beyond the setup for the quick start. The following example illustrates the setup the achieves the following objectives:

1. Sprinklers enabled in 15 zones of lawn when soil moisture below 0.5 equivalent rain inches
2. Sprinklers enabled every other day for 3 zone garden
3. Water can only be used for irrigation on even days of the month
4. Sprinklers disabled during the heat of the day
5. Sprinklers disabled when it is windy
6. Sprinklers disabled if rain forecasted within two days
7. Only enough water pressure to do one zone at a time
8. Need to do a precheck of the zones to confirm all valves and heads are in order
9. Rain8-X10-2 units to be used
10. Pump used for all irrigation

Setup1-Rain8. Similar procedure as in the prior scenarios with a caveat that the Rain8 X10-2 units need to be programmed with different house/bank codes. Assume the programming is setup for N1 through N8 and N9 through N16 to handle the 15 lawn zones. M1 through M8 for the garden zones. In the case of the M1 through M8 module it needs to be configured to use Valve 8 as the pump control. When all the three units have been programmed there will be 23 available zones and 1 pump, which is adequate for the 18-zone requirement.

No other X10 automation controller exists so the X10-2 modules can be configured in the optimal Ack on Cmd and Poll configuration and the default 5 seconds between commands is acceptable setup for the X10/RF Interface section.

Setup2-Wiring. Similar procedure as in other two scenarios.

Setup4-Zone. Similar procedure as in the other scenarios, but in this case we are also concerned with the ability to manually control the valves for only short duration testing. Because of this a time should be entered for each of the Manual time boxes that are being used. When a valve is turned on manually then it will run for the Manual time number of minutes or until it is manually turned off.

Setup5-Area. Similar procedure as in the other scenarios. In this case, however the control strategy for the lawn is selected to be calculated with the radio button and the threshold box under it is set to be 50%. For the Garden and Lawn the pump will be selected

Since the water pressure is limited then only one zone should be watered at a time. This specification is made in each of the two area sections of the page to specify that the sequencing is part of a single master sequence. If the checkbox is unchecked then the two lawn areas will be watered in parallel rather than in series.

Setup6-Restrictions. A variety of restrictions are imposed in this scenario. Each of these is entered on this page. The “heat of the day” limitation can be coded in the Between Hours boxes. Perhaps values of 11:00 and 18:00 would be appropriate times to not allow watering to occur. “Windy” may be translated to a value of 10 MPH for 5 minutes. This means that over a 5-minute period the average wind speed must be less than 10 MPH. Forecasted precipitation implies a reasonable probability of rain. An entry of 50 percent, 2 days, and the corresponding checkbox will result in a watering restriction if either of the next two days has at least a 50% probability of precipitation.

Setup7-Remote Control. The ability to pre-check the valves implies manual control, but also may imply the use of a remote control pad. The remote control pad will send RF codes consistent with X10 protocol and these need to be received and associated with specific valves. There are 18 zones so 18 discrete House/Unit code values will need to be entered. For simplicity the unit codes should be the same as the

valve codes. This means something like K1 through K3 and L1 through L15 could be entered into each box on the Remote Control Page.
Remote input also implies an interface to remote signals. A W800 is attached to COM2 as the RF receiver so 2 is entered for the W800 port.

Setup8-Weather. The wind speed data is obtained from a local reporting station. The available stations are contained in the pull downs in the Weather group of this page. The stations are associated with zip codes so a change in zip code will change the list of available stations. Up to three stations can be specified to handle the cases when a station happens to be inoperative.

3.5.3.5 Scenario 5 – Dual PC – Dual Hardware Interface Configuration

The dual PC configuration will build upon Scenario 4 setup by showing the additional considerations for the redundant configuration. There are a variety of redundant configuration setups. This one will assume the following hardware;

Two CM11A Power line interfaces
Two W800 RF Interfaces
Two Computers running in Active/Standby irrigation mode
    Computer 1 name is MAIN and contains CM11A interface and W800 interface
    Computer 2 name is GARAGE and contains CM11A interface W800 interface
Same Rain8 controller hardware as scenario 4

The setup will be performed on the primary computer first and then when completed a few changes will be made from the secondary computer. The following applies to the primary computer (MAIN). This computer needs to have the folder where mcsSprinklers is installed to be shared over the LAN. Consult your Windows operating system documentation to make this folder shared.

Computer # 1 (MAIN)

Setup1-Rain8. No Change

Setup2-Wiring. No Change

Setup4-Zone. No Change

Setup5-Area. No Change.

Setup6-Restrictions. No Change.

Setup7-Remote Control . No Change

Setup9-Other. Redundancy backup mode selected as "Standby Backup". This will cause a blue highlight to the middle of the Others page when the Save is clicked.

Computer #2 (GARAGE)

On the second computer (GARAGE) the mcsSprinklers application is started after the computer # 1 setup is complete. This will allow the sharing of the setup that was previously done. It can be changed from either computer at any time and both will be updated.

Setup9-Other. Redundancy backup mode selected as "Standby Backup". This will cause a blue highlight to the middle of the Others page when the Save is clicked. Note the backup mode setting is the same as on the first computer. The setup entries shown in blue are not shared so each needs to be made individually on each computer.

Redundancy Backup Mode\Path to primary mcsSprinklers edited to change the computer name (GARAGE) to (MAIN). This path is where the configuration information is stored. It will be stored only on one computer and MAIN was selected to be the primary. After editing it will show as \\GARAGE\C\Program Files\mcsSprinklers.

3.5.3.6 Scenario 6 – Dual PC – Single Hardware Interface Configuration

The dual PC configuration will build upon Scenario 4 setup by showing the additional considerations for the redundant configuration. There are a variety of redundant configuration setups. This one will assume the following hardware

- One CM17A Wireless interface
- One W800 RF Interface
- Two Computers running in Active/Standby irrigation mode
  - Computer 1 name is MAIN and contains CM17A interface
  - Computer 2 name is GARAGE and contains W800 interface
- Same Rain8 controller hardware as scenario 4

The setup will be performed on the primary computer first and then when completed a few changes will be made from the secondary computer. The following applies to the primary computer (MAIN). This computer needs to have the folder where mcsSprinklers is installed to be shared over the LAN. Consult your Windows operating system documentation to make this folder shared.

Computer # 1 (MAIN)

Setup1-Rain8. Module PC Interface selects "External via XAP Address". The address in the text box can be left blank since only one interface node will be implemented. Commands to control the Rain8Wireless will now be delivered as xAP messages over the LAN rather than as a direct connection to the CM17A.

Setup2-Wiring. No Change

Setup4-Zone. No Change

Setup5-Area. No Change.

Setup6-Restrictions. No Change.

Setup7-Remote Control. The W800 IP and W800 Port boxes are left blank. This means there is no W800 directly connected to this PC, but will get the W800 reports via the LAN.

Setup9-Other. Redundancy backup mode selected as "Standby Backup". This will cause a blue highlight to the middle of the Others page when the Save is clicked.

Launch Redundant Application on Startup/Rain 8 Interfaces/Wireless Interface checkbox checked so that the interface to the CM17A will be activated next time mcsSprinklers starts. The interface software user interface will appear in the tray as a missile-like icon. When this icon is clicked a setup option will appear and the port number entered for the CM17A interface is entered. Note that is secondary setup can only be done after mcsSprinklers has been restarted.

Supplemental xAP Interface/Start Hub checkbox is checked. This will allow xAP communications on this computer.

Computer #2 (GARAGE)

On the second computer (GARAGE) the mcsSprinklers application is started after the computer # 1 setup is complete. This will allow the sharing of the setup that was previously done. It can be changed from either computer at any time and both will be updated.

Setup9-Other. Redundancy backup mode selected as "Standby Backup". This will cause a blue highlight to the middle of the Others page when the Save is clicked. Note the backup mode setting is the same as on

the first computer. The setup entries shown in blue are not shared so each needs to be made individually on each computer.

Redundancy Backup Mode\Path to primary mcsSprinklers edited to change the computer name (GARAGE) to (MAIN). This path is where the configuration information is stored. It will be stored only on one computer and MAIN was selected to be the primary. After editing it will show as \\GARAGE\C\Program Files\mcsSprinklers.

Launch Redundant Application on Startup/Rain 8 Interfaces/Handheld Remote checkbox should be checked so that the interface to the W800 will be activated next time mcsSprinklers starts. The interface software user interface will appear in the tray as a ray-like icon. When this icon is clicked a setup option will appear and the port number entered for the W800 interface is entered. Note that is secondary setup can only be done after mcsSprinklers has been restarted.

Supplemental xAP Interface/Start Hub checkbox is checked. This will allow xAP communications on this computer.

Supplemental xAP Interface/xAP UID changes from FF000800 to FF000900 to give the second instance of mcsSprinklers a unique identification on the LAN.

4 Physical Installation

The physical installation consists of routing wires from the field to the Rain8 or EtherRain controllers, the connection of controllers to the personal computer(s) and connection of the computer(s) to the Internet. Obviously each new location will have new wiring routed and valves installed. The setup for the initial configuration will be performed per the steps in the following paragraphs. [Version-Dependent Capability] If a second installation is done, then the setup can be based off of a prior install by transferring the configuration file contained in c:\program files\mcsSprinklers\mcsSprinklers.ini.

4.1 Field Wiring

Wires from the valves in the field are usually bundled in one or more harnesses and each wire in a harness is color-coded. When multiple harnesses are used then each harness needs to be manually labeled to assure that the proper harness is identified as it is being installed in the controller. Valve wiring is a low voltage-capacity where the wire gauge requirements are based upon the distance from the valve to the controller. There are no special electrical shielding requirements for wires in this harness. Wires may also be run for flow meters or moisture probes. These may have special requirements for shielding or proximity to other types of wires and this need to be obeyed for a successful install.

The terminal end of a wiring harness is connected to one or more Rain8 or EtherRain controllers. The Rain8 controllers are located at a convenient location that is protected from the weather. The controllers can be collocated or located at locations this is convenient based upon the source of the harness. A collocated organization will tend to have better long-term serviceability.

Each Rain8 or EtherRain module can accommodate seven or eight wires. Each wire is connected to a post in the terminal block. At least one common return wire needs to be installed in a terminal post. The 8th valve position in the terminal block may be connected to a valve or to a pump. The use of the pump control in this manner will dependent upon the type of Rain8 or EtherRain controller and this will be discussed later. The terminal block is not installed in the Rain8 at this time, but it should be manually labeled so the correct Rain8 controller is later mated to the proper terminal block.

4.2 Controller Connection

4.2.1 Controller to PC

Three models of Rain8 controllers are available with the primary difference between each being the mechanism by which it is connected to the personal computer. The connection methods are a low-voltage cable, an interface to the high-voltage AC power line, and an interface for wireless radio frequency connection.

The Rain8-Net module uses a RS232 cable that plugs into a COM serial port of the PC. Additional Rain8-Net modules are interconnected with RS485 cables.

The Rain8-Wireless module listens for commands via radio frequency transmissions. The PC can generate these commands with an interface to one of its COM ports. The most basic of these interfaces is a CM17A/Firecracker. RF communications can penetrate walls, but are also sensitive to nearby RF noise sources. For this reason it may be desirable to connect an RS232 extension cable between the PC's COM port and the CM17A. Additional Rain8-Wireless modules are interconnected with RS485 cables.

The Rain8-Power line module listens for commands per the X10 protocol on the household AC wiring. The electronics at both the PC and Rain8-Power line end cannot be directly plugged into the 120VAC line. The Rain8-Power line module uses a TW523 adapter to protect it. Up to two Rain8-Power line modules can share one TW523 adapter. The PC-side connection is a CM11A connection to a PC's COM port. The CM11A and CM17A can share the same COM port if both types of Rain8 modules are used.

The EtherRain is connected to the LAN with typical Cat5/6 cable to an Ethernet switch or router. Multple modules are connected via different ports on the switch or router.

Since multiple Rain8 modules can be used in a single installation it is necessary to configure each module to respond to a unique address. This configuration is done from the Setup1-Rain8 page. The programming of any Rain8 module is done one module at a time. The module is connected to a COM port on the PC. The module **cannot** have the terminal block with the valve wires connected. . In the basic and Standard versions of mcsSprinklers this is done with a utility program downloaded from the WGL website. (download r82.zip for 2-way Rain8II or rain8config.zip for 1-way Rain8)

Figure 8 shows the segment of the Setup1-Rain8 page that is used for configuring the Rain8 module. The Rain8module contains an EPROM and all settings for the EPROM are done at one time. This includes the module address; pump configuration, and timer setup. The COM connection to the PC that is being used for the programming and the type of module is identified to start the process. The programming is performed by filling in all the fields shown in Figure 8 and then clicking the Write EPROM button. To confirm the setup was properly saved to the Rain8 device, click the Read EPROM button to read the current contents of the Rain8 EPROM.

After a module type selection is saved the remainder of the EPROM setup will show dark grey fields for the settings that are not available for the selected module type.

The timer values in the right column are used to set a minimum time for that valve. This should be set to a value greater than the amount of time you plan to have that zone run. They are used to protect the system by placing an absolute limit on the time that a valve will be allowed to remain open. In the case of the Rain8-Net, Rain8-UPB, and Rain8-X10-2 this safety feature can be overridden with the checkbox entry. The other modules have no override. Values in the range 1 to 250 are acceptable.

Note also the special configuration for a pump on the Rain8-Wireless unit. This model will allow the 8th valve to be slaved to the other seven with the intention that it will control a pump. When any of the first seven are ON then the 8th will be ON and when all are OFF then the 8th will be OFF.

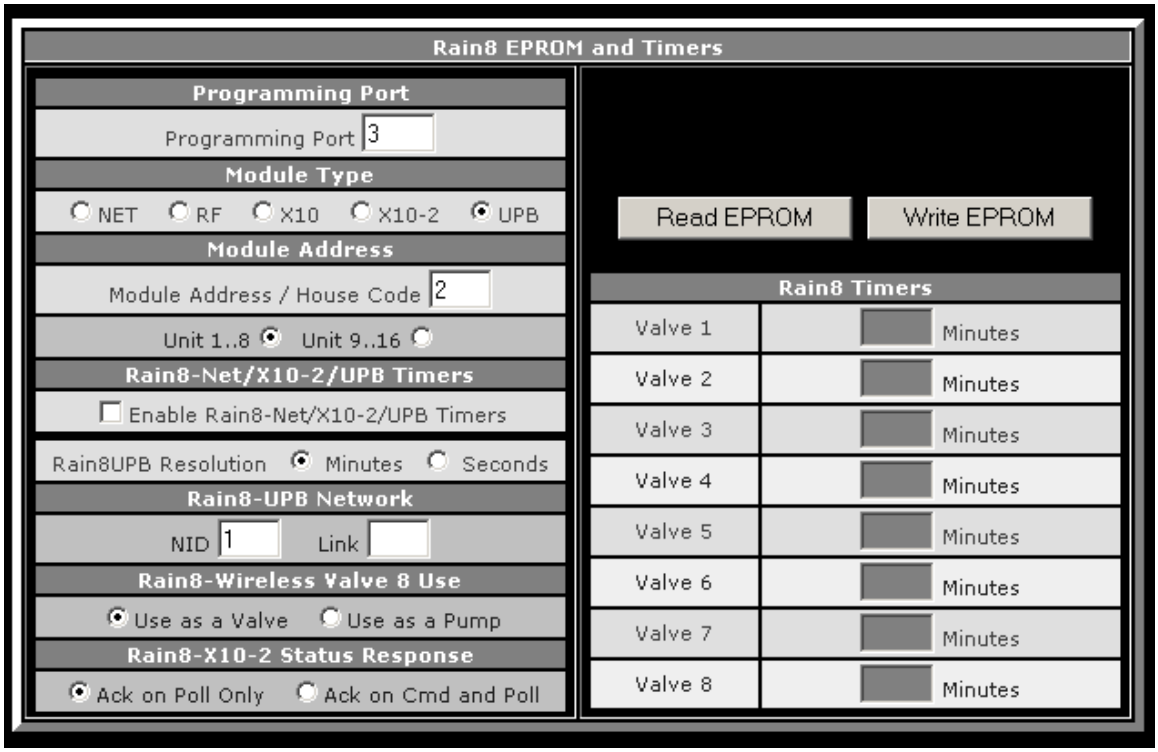


Figure 8 Rain8 Address and Timer Setup

Once the controllers have been assigned an address and the other EPROM parameters set and saved the Rain8 modules can be connected to the terminal block. This can be done later as well. In either case the configurations that have been programmed need to be entered into the top part of the Setup1-Rain8 page unless the Homeseer interface is being used. In that case no entry is needed for the Wireless or Power line sections of Figure 9.

In operational use each type of module is connected via a COM port to the PC or via the Local Area Network (LAN) to another PC with a usable COM port. This COM port may or may not be different than the one used for programming the module. The port used is entered into the text box shown in Figure 9 if the local computer contains the CM17A/CM11A interface.

It is also possible to interface the module using a remote interface rather than one directly connected to the computer. The remote interface must be somewhere on the LAN and at the remote location an interface module will be installed and the interface software run. The interface modules are those shown in Table 2. The remote vs. internal connection is selected and if remote, then the target address of the interface is entered. This address can be wild carded so an entry such as *.*.* will usually accomplish the objective.

In the case of all Rain8 types except the Wireless, it is possible to interface these devices with LAN connection to an IP/Serial converter. These adapters can be wireless or wired. Communication to these devices can be direct to the IP and Port of the IP/Serial converter or can be through a port driver that maps the IP/Serial device to an extended COM port. The setup of the Rain8UPB in Figure 9 shows the connection directly to the IP/Serial device. If a COM port is used then the port entry would be simply the port number such as 6 and the IP entry would be blank such as is shown for the Rain8Net connection.

When using the Homeseer X10 interface, the entry that should be made is the list of Homeseer devices per Paragraph HomeSeer Devices or X10 devices per the grid of Figure 11

The Save button at the top of the page is used to record the settings.

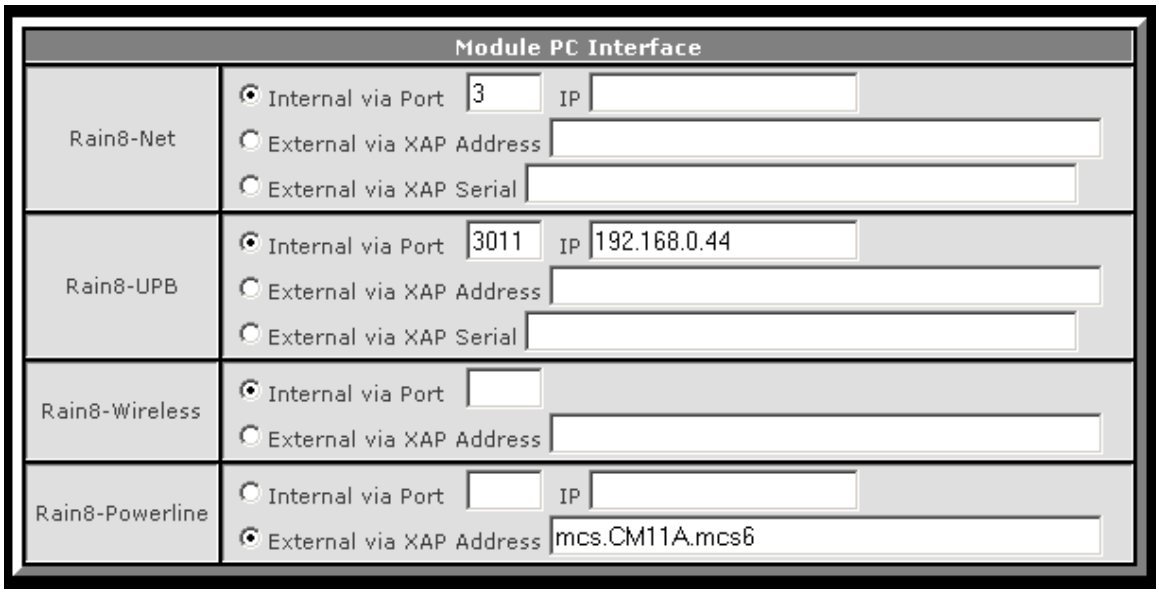


Figure 9 Rain8 Modules to PC Connection Setup

For the X10 power line and RF interfaces additional information is used to characterize how the interface will be used. This is shown in Figure 10. A gap is placed between X10 commands to relieve loading on

the power line. This delay is entered as the number of seconds between each command. In the case of the Rain8X10-2 the module itself will provide a status response identifying the state of its valve. When the EPROM of the module is programmed it can be set to immediately respond with status after a command or it can be configured to respond with status only on a status request command. If it configured to respond only after a status request then mcsSprinklers will issue a status request after some delay after each valve command. The delay time is a user-selectable entry. In the case of the Homeseer configuration where the X10 interface is managed by Homeseer, then the EPROM must be configured to respond only on poll since Homeseer does not know how to deal with an automatic status response. The delay timing parameters are managed by mcsSprinklers to assure that reasonable values are entered. The typical response time between a Rain8X10-2 status request and its response is 3 to 4 seconds. This means that the command-to-command delay should be greater than 4 seconds to assure that the status is not being returned at the same time as the next command is being issued and the two collide.

The two buttons shown in the interface test (Figure 10) can be used to test the interface connection. In this case an ON command followed by a five second delay and then OFF is sent over the interface that corresponds to the button. These can be used to check the connectivity of the interface setup.

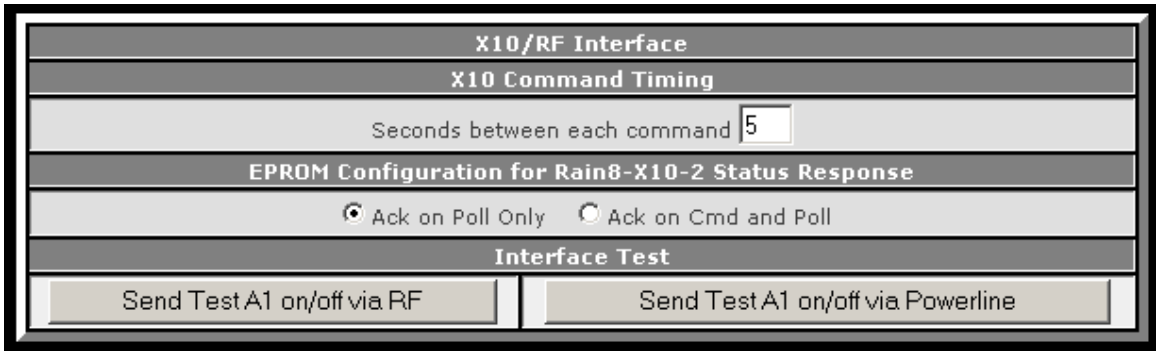

X10/RF Interface
X10 Command Timing
Seconds between each command 5
EPROM Configuration for Rain8-X10-2 Status Response
Ack on Poll Only
Ack on Cmd and Poll
Interface Test
Send Test A1 on/off via RF
Send Test A1 on/off via Powerline

Figure 10 X10 Interface Characterization

The addresses that were assigned to the Rain8 modules are entered into the middle panels of the Setup1-Rain8 page. This area is shown in Figure 11, Figure 12 and Figure 13.

The Rain8 Net/WiFi can be connected to a single PC port or multiple ports. A typical configuration is a single port connection with all Rain8 modules connected together with RS485 daisy-chained cables between each module. In this case there is one master. If the rain8 modules cannot be physically daisy-chained and still connect to the valve wiring then multiple PC ports can be used to make the connection. In this case there are multiple masters. This selection is made in the Master Modules text box shown in Figure 12.

In the case of the Rain8-Net / WiFi there are two methods to identify the modules that will be put into service. One is to allow mcsSprinklers search for the modules and the other is to enter the module number in the text box. The easiest method is to enter the module numbers with a comma separating each in the text box provided. To use the search method the Find Rain8 Modules button is clicked. A new window will appear with the current address being search displayed. When this address goes beyond the highest number programmed into the EPROM then the same button can be clicked again to stop the search. It will stop itself at 255 if not manually stopped.

When multiple masters are connected then this process is repeated for each master. If the interface method is via xAP it can be considered a single master and all module numbers entered into a single text box.

The normal wait time allowed for a response from the Rain8Net is 5000 milliseconds. This can be increased to deal with an underpowered computer that may not be able to sustain the load it is carrying.

The Rain8Net supports a protocol that provide acknowledge of each command and allows the status of valves within the module to be queried. mcsSprinklers will always wait for acknowledgement and retry

commands up to four times before declaring a valve failed. Options are available to allow mcsSprinklers to query the module after a command or every minute. If a status response is not what mcsSprinklers expected for the valve then mcsSprinklers will send command(s) as necessary to place the valves in the correct state. For the status polling to be effective the quality of the communication with the Rain8Net modules must be good. This is especially true when polling every minute. Some interfaces tend to buffer commands so the timing relationships are not maintained and responses will not be available in the expected time window allowed.

For the Rain8-UPB the modules are identified by a text box shown on Figure 13. Each Rain8-UPB module will occupy 8 UPB Device ID's. Module #1 will be DID's 1 through 8. Module #2 will be DID's 9 through 16, etc.

In the case of the other two module types there is no mechanism for the module to report its address when not connected to the programming port. For these, and when not using the Homeseer X10 Interface to control the module, the addresses of all units that are installed needs to be entered into the grid of Figure 11. This includes the identification of the module type and if it was programmed to respond to addresses 1 to 8 or 9 to 16.

Rain8 Wireless and X10 Powerline Interface Module Assignments		
House	Bank 1 to 8	Bank 9 to 16
A	◉ None ○ Wireless ○ X10 ○ X10-2	◉ None ○ Wireless ○ X10 ○ X10-2
B	◉ None ○ Wireless ○ X10 ○ X10-2	◉ None ○ Wireless ○ X10 ○ X10-2
C	◉ None ○ Wireless ○ X10 ○ X10-2	◉ None ○ Wireless ○ X10 ○ X10-2
D	○ None ○ Wireless ○ X10 ◉ X10-2	○ None ○ Wireless ○ X10 ◉ X10-2
E	○ None ○ Wireless ○ X10 ◉ X10-2	◉ None ○ Wireless ○ X10 ○ X10-2
F	◉ None ○ Wireless ○ X10 ○ X10-2	◉ None ○ Wireless ○ X10 ○ X10-2
G	◉ None ○ Wireless ○ X10 ○ X10-2	◉ None ○ Wireless ○ X10 ○ X10-2
H	◉ None ○ Wireless ○ X10 ○ X10-2	◉ None ○ Wireless ○ X10 ○ X10-2
I	◉ None ○ Wireless ○ X10 ○ X10-2	◉ None ○ Wireless ○ X10 ○ X10-2
J	◉ None ○ Wireless ○ X10 ○ X10-2	◉ None ○ Wireless ○ X10 ○ X10-2
K	◉ None ○ Wireless ○ X10 ○ X10-2	◉ None ○ Wireless ○ X10 ○ X10-2
L	◉ None ○ Wireless ○ X10 ○ X10-2	◉ None ○ Wireless ○ X10 ○ X10-2
M	◉ None ○ Wireless ○ X10 ○ X10-2	◉ None ○ Wireless ○ X10 ○ X10-2
N	◉ None ○ Wireless ○ X10 ○ X10-2	◉ None ○ Wireless ○ X10 ○ X10-2
O	◉ None ○ Wireless ○ X10 ○ X10-2	◉ None ○ Wireless ○ X10 ○ X10-2
P	◉ None ○ Wireless ○ X10 ○ X10-2	◉ None ○ Wireless ○ X10 ○ X10-2

Figure 11 Rain8 X10-based Module Address Setup

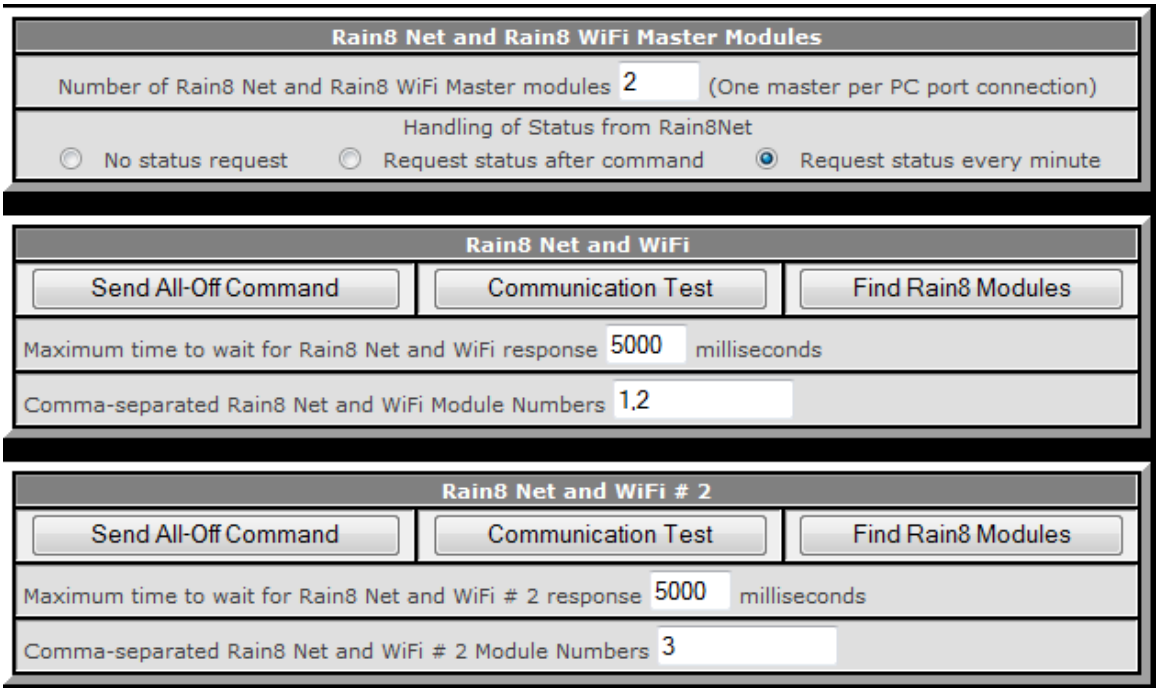

Rain8 Net and Rain8 WiFi Master Modules
Number of Rain8 Net and Rain8 WiFi Master modules 2 (One master per PC port connection)
Handling of Status from Rain8Net
No status request
Request status after command
Request status every minute
Rain8 Net and WiFi
Send All-Off Command
Communication Test
Find Rain8 Modules
Maximum time to wait for Rain8 Net and WiFi response 5000 milliseconds
Comma-separated Rain8 Net and WiFi Module Numbers 1,2
Rain8 Net and WiFi # 2
Send All-Off Command
Communication Test
Find Rain8 Modules
Maximum time to wait for Rain8 Net and WiFi # 2 response 5000 milliseconds
Comma-separated Rain8 Net and WiFi # 2 Module Numbers 3

Figure 12 Rain8 Net-based Module Address Setup

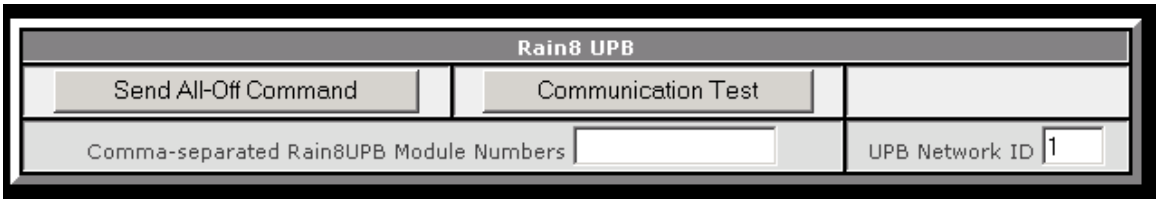


Figure 13 Rain8 UPB Module Address Setup

The EtherRain is identified by its Name, IP address and port. The "Find EtherRain Modules" button is used to populate the information. This will list each module on the LAN and complete the number of modules text box. If the information is correct the "Save Changes" button at the top of the page should be used to record the discovered information. When mcsSprinklers starts it will show a blue circle next to each EtherRain module name. It will change to green after successful communication to it and red after it fails to respond.

If a setup is being done without the EtherRain modules connected the "Number of Modules" text box should be completed and a set of blank rows will be presented as placeholders. The module names can be entered and the IP will be populated automatically later when the modules are connected. When taking this offline approach it is important to correctly name the modules with the Quicksmart admin utility prior to connection to the LAN so the positional relationships of the modules will be maintained. During a Find operation mcsSprinklers will add modules to the list, but will never remove modules. Modules are removed by clearing the name field and doing a "Save Changes". Relative position is important so it will be better to rename modules rather than remove them to maintain zone identities that are later setup. This is true even if a module is permanently removed.

Each module must have a unique name and these can be programmed with the Quicksmart admin utility. The IP address is determined from the network definition. This will be either with DHCP by the LAN's router or statically if so programmed with the Quicksmart admin utility. The default is DHCP. mcsSprinklers will be testing a change in IP address as it communicates with the EtherRain module and will perform the necessary updates should a DHCP assignment change.

Each EtherRain module will enforce a password access. mcsSprinklers expects the same password to be setup on each EtherRain module. The password is conveyed to mcsSprinklers as shown in Figure 14. The password will be "pw" unless changed with the Quicksmart admin utility.

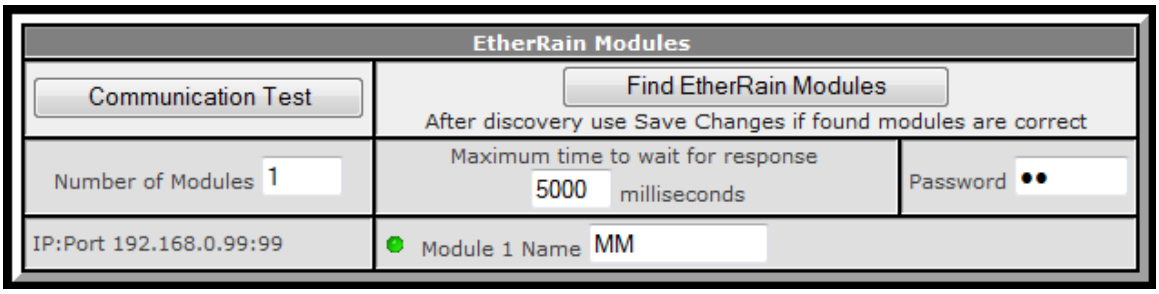


Figure 14 EtherRain Module Address Setup

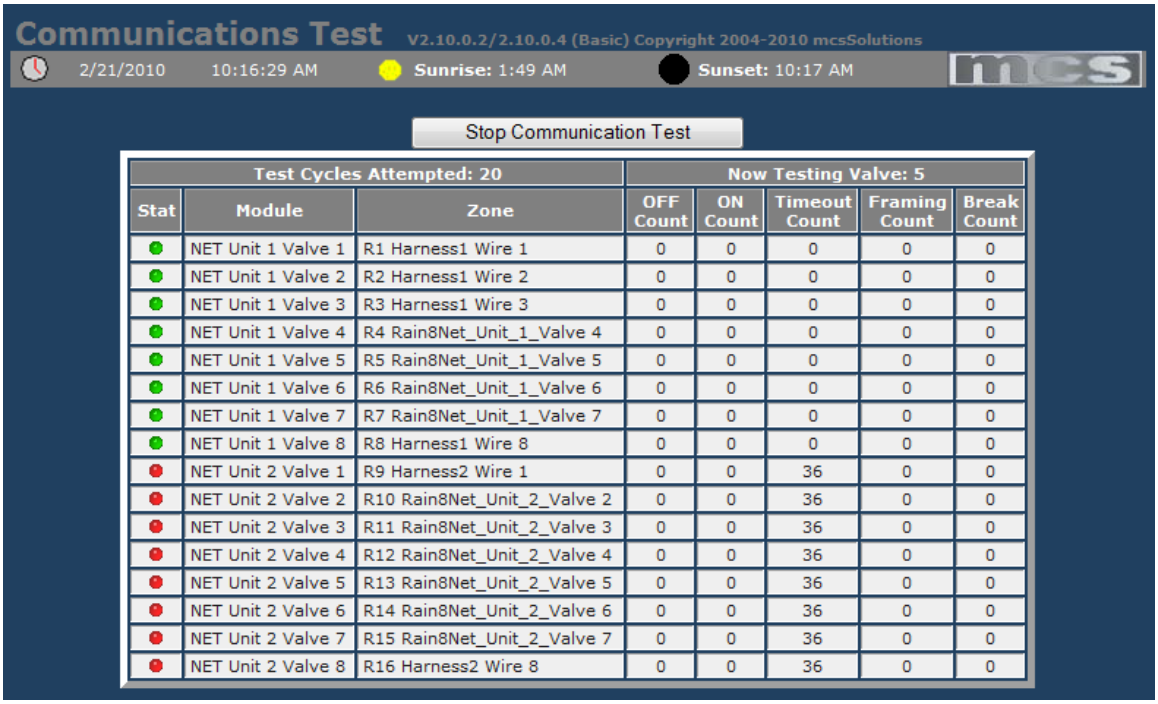
4.2.2 Communication Test

The ability to communicate between the computer and all the Rain8 modules depends upon solid connections between the modules and with the computer. The Rain8Net and Rain8UPB can be configured with multiple modules and a single interface to the computer. A communication test capability is included to evaluate the quality of the connection for these two types of modules. The communication test is run by clicking on one or the other of the Communication Test buttons on the Rain8 Setup page. (Figure 12 and Figure 13).

When activated a new browser display will show each of the defined valves and the status of communication with each. The test is performed by requesting a status from each valve. Counts are maintained for unexpected ON, unexpected OFF, and No-response timeouts and RS-232 protocol errors as shown in Figure 15. Colored icons are also shown in the Stat column to provide a quick visualization of the overall status.

The test is performed by setting a single valve in every module ON and then polling each module for the status of its eight valves. For a large number of Rain8 units consideration needs to be given to the amperage available from the 24VAC transformer as it will need to be able to power one valve per module simultaneously.

The results shown in Figure 15 illustrate a system where only the first Rain8Net module has a communication connection for a test that was run for 20 cycles with timeout showing 36 counts. This equates to timeouts on the commands and the retries of the commands. A situation like this is indicative of a lack of 24VAC applied to the modules or poor wiring between the first and second modules. The counts show the number of failures experienced. A count in the OFF column, for example, indicates that an OFF was expected, but not observed.



Test Cycles Attempted: 20			Now Testing Valve: 5				
Stat	Module	Zone	OFF Count	ON Count	Timeout Count	Framing Count	Break Count
	NET Unit 1 Valve 1	R1 Harness1 Wire 1	0	0	0	0	0
	NET Unit 1 Valve 2	R2 Harness1 Wire 2	0	0	0	0	0
	NET Unit 1 Valve 3	R3 Harness1 Wire 3	0	0	0	0	0
	NET Unit 1 Valve 4	R4 Rain8Net_Unit_1_Valve 4	0	0	0	0	0
	NET Unit 1 Valve 5	R5 Rain8Net_Unit_1_Valve 5	0	0	0	0	0
	NET Unit 1 Valve 6	R6 Rain8Net_Unit_1_Valve 6	0	0	0	0	0
	NET Unit 1 Valve 7	R7 Rain8Net_Unit_1_Valve 7	0	0	0	0	0
	NET Unit 1 Valve 8	R8 Harness1 Wire 8	0	0	0	0	0
	NET Unit 2 Valve 1	R9 Harness2 Wire 1	0	0	36	0	0
	NET Unit 2 Valve 2	R10 Rain8Net_Unit_2_Valve 2	0	0	36	0	0
	NET Unit 2 Valve 3	R11 Rain8Net_Unit_2_Valve 3	0	0	36	0	0
	NET Unit 2 Valve 4	R12 Rain8Net_Unit_2_Valve 4	0	0	36	0	0
	NET Unit 2 Valve 5	R13 Rain8Net_Unit_2_Valve 5	0	0	36	0	0
	NET Unit 2 Valve 6	R14 Rain8Net_Unit_2_Valve 6	0	0	36	0	0
	NET Unit 2 Valve 7	R15 Rain8Net_Unit_2_Valve 7	0	0	36	0	0
	NET Unit 2 Valve 8	R16 Harness2 Wire 8	0	0	36	0	0

Figure 15 Communication Test for Rain8Net and Rain8UPB

4.2.3 HomeSeer Devices

mcsSprinklers can accept any Homeseer devices to be used as the zone and pump valves. In this situation the physical interface to the valve is managed by Homeseer with the logical control of these devices performed by mcsSprinklers. It is possible to have a combination of directly-connected Rain8 units and Homeseer virtual devices. The list of Homeseer devices is identified as a comma-separated list of devices codes as is shown in Figure 16.

Figure 16 Identification of Homeseer Devices

4.2.4 Interface Protocol

The Rain8-Net communication typically consists of a three-byte command followed by a three-byte acknowledges. mcsSprinklers confirms that the proper acknowledge bytes are received. If not, then it will retry once per command sent. When a valve control command is sent to the Rain8-Net, mcsSprinklers will also send a status request. If the expected status is not received then it will send the command a second time. Each Rain8-Net module can have up to four valves on at the same time. mcsSprinklers will verify that no more than four are on and will ignore commands for additional valve-on until other valves have been turned off.

The Rain8-Wireless communications via the CM17A interface uses the DTR and RTS discrete signals of the COM port to provide power and to command the transmission of RF codes. The modulation rate of

DTR and RTS determine which RF code is transmitted. No status feedback is available on the RF interface.

The Rain8-Power line communications via the CM11A interface uses a five-byte command packet. Acknowledgement is received for a successful transmission and if not received the command is resent. This acknowledge, however, only relates to delivery of the command onto the power line. It does not necessarily it is received by the Rain8-Power line. The CM11A also listens to commands from other sources such as a remote control device. The data reception events are processed by reading the delivered command.

An additional diagnostic aid is available to see the serial communication to the valve hardware. It is referenced from the Serial IO link or /iowindow page on the mcsSprinklers URL from the browser. Each character that is sent or received on the COM port is displayed in this window.

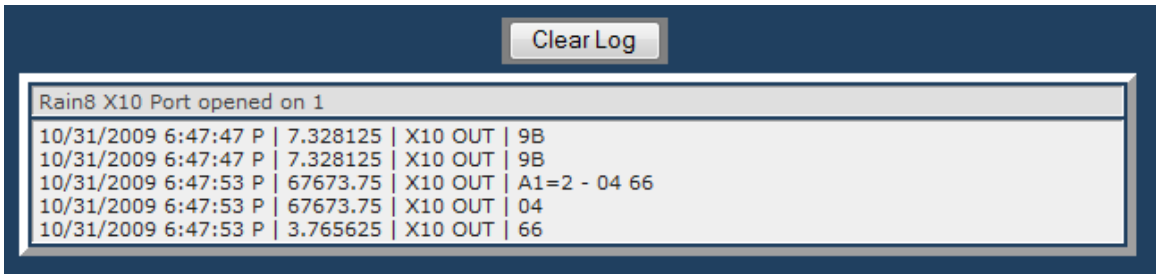


Figure 17 Serial IO Communications Diagnostic Window

4.2.5 Valve Wire to Controller

The valve wires have previously been routed from the field and installed in the Rain8 terminal blocks. The next step is to identify how these wires were connected to the terminal block (i.e. what valve wire is associated with which Rain8 valve control). This setup is done with the Setup2-Wiring page shown in Figure 18.

The control valves that are available will be shown in the pull down in the second column of the page. The valves available are those identified in the prior step. The Location column is used to provide a recognizable name for the zone that is controlled by the valve. This location name is used for status display and voice commands.

The Picture File is the file path to a digital image that shows the landscape covered by the valve wire. It is used later as a popup image for zone reference identification and as the primary identification method when using the touch-screen graphic interface.

The upper right corner of each harness group is a value that identifies how many wires are contained in the harness. It will default to 8 and can be expanded or reduced by changing the number in the box followed by a Save. The upper left contains a text box to enter any labeling information that may help to identify the wire bundle. This labeling information is not used elsewhere. It is provided here as a means of retaining the information for future reference.

The page will always show one harness at the bottom that has no wires present. If wires are added followed by a Save, then a new blank harness will appear at the bottom.

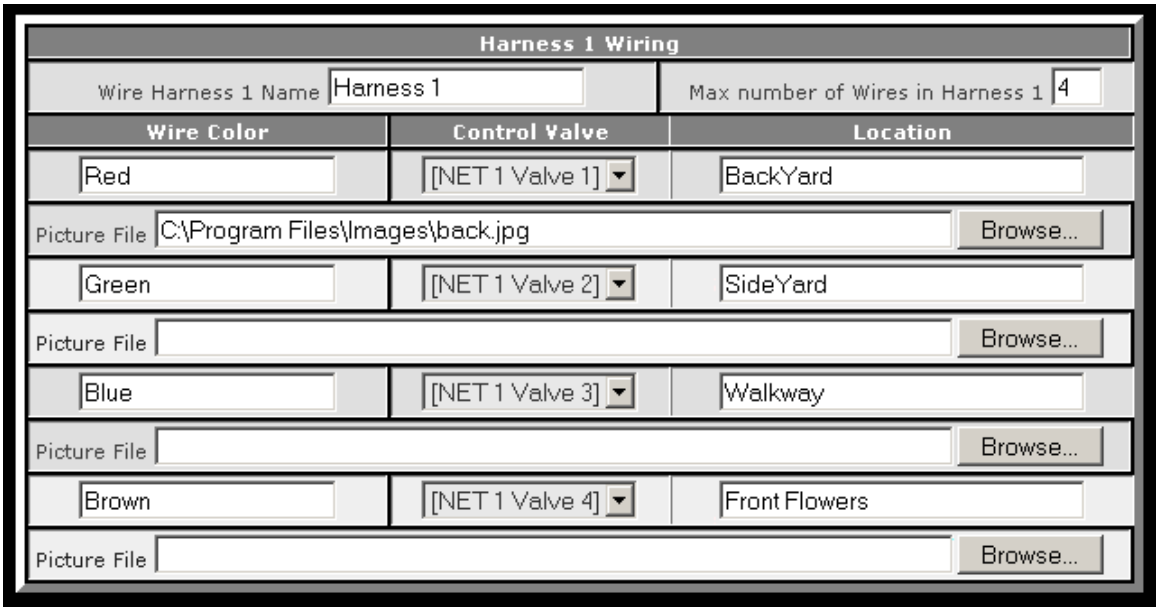


Figure 18 Harnesses Wiring to Rain8 Valve Setup

The Layout setup is used to make assignments as to how each valve will be used and make basic assignments of how long the valves will be enabled. The Zone setup is used to provide additional information about zone. This includes efficiency of application, and rate of drainage or sunlight exposure and water utilization rates. These setup options are shown in Figure 19 and Figure 20 .

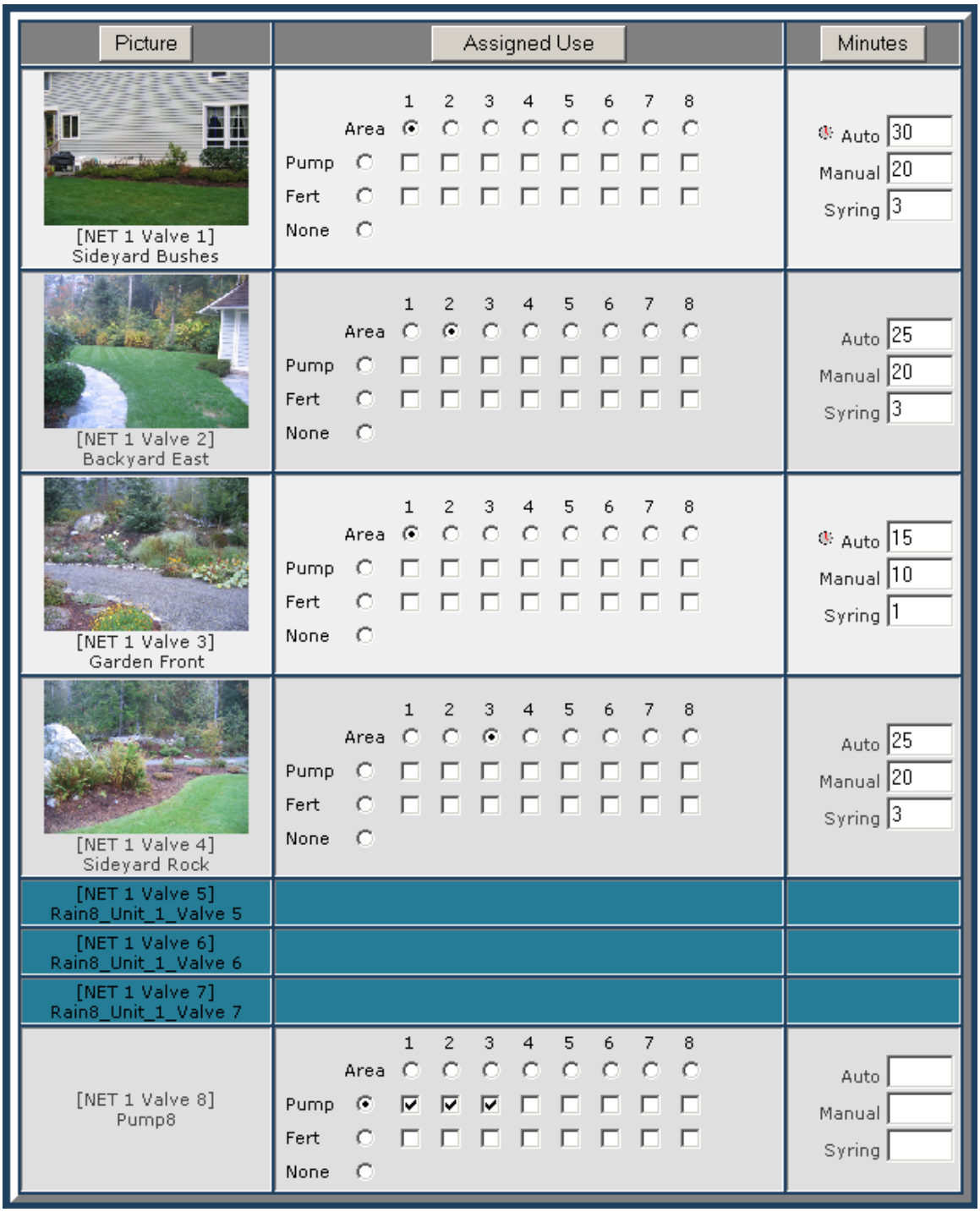


Figure 19 Layout Page

The watering strategy to be applied to a zone is described in Automated Control Strategy. "Auto" Minutes applies to this strategy. The time for the first program is shown on the zone setup page. If multiple watering times (i.e. programs) are defined for an Area then a clickable icon will appear next to the Auto time entry. By default the zone's duration for each program is the same, but can be tailored with a different duration for each watering period. By selecting a zero value for a zone's program the zone will be

excluded from this specific program, but still participate in others. Clicking the icon will bring up the panel as shown in Figure 21.

“Manual” Minutes applies to direct or remote control. Manual control will supersede auto program control and can be used as often as desired without affecting the total duration of the auto program.

“Syringing” Minutes is the light sprinkling of water on turf usually done during the hottest part of the day to prevent wilting. During the hottest days of the year the Evapotranspiration rate often exceeds the plants ability to draw water in from the soil. The result of this water deficit is wilt. To reduce the stress from this water deficit syringing is used. It does not actually replacing the water in the soil but instead it reduces the wilting cycle by cooling off the turf and temporarily stopping wilt until rainfall or hand watering can be initiated.

“Soil” Efficiency factor relates to the effectiveness of water saturation when it is applied and the ability to retain water within the crop. Nominal soil and grass is represented by default 0.75. Higher factors will reflect a slower moisture loss rate.

“Rain” factor relates to the degree that rainfall will reach the soil level. Uncovered zones will be 1.0 and fully sheltered zones will be 0.0.

“Fert” factor is the fraction of zone’s time that the Area’s fertigation valve is enabled when the zone is enabled. This is used to apply liquid fertilizer through the irrigation system.

“Flow” Calc is the estimate of the gallon/liter per minute flow rate delivered by the total of all valves heads of the zone. The total cumulative flow volume is reported in a status device on the General Status page and Calendar.

“Flow” Max is the maximum daily water use to be measured for the zone. When this value is exceeded a notification will be provided via the message log and email if setup. This value is only used when a water meter is present to measure the water use when a zone is active. Another approach to water monitoring is based upon exceeding the averages that are expected. This is done from the Area Setup page.

The default number of zones allowed per area is 12. This can be changed by the text box entry in the upper right of each area’s set of zones. A Save is required to affect the change of this text box entry.

In the top left of each area is a location to enter the name of an Area. If it is used then this name will be added to status displays and control buttons to help identify the Area being viewed. The names selected should be short otherwise the long name may interfere with the space allocated for area identifications on the Zone Status page.

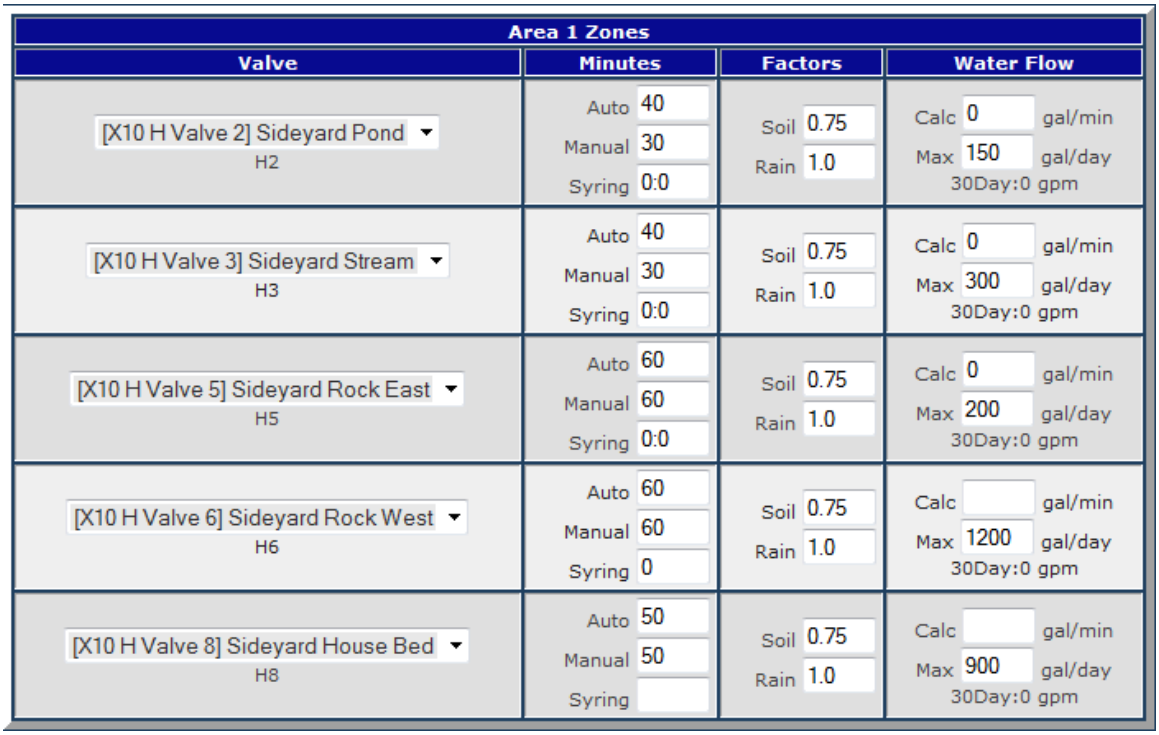


Figure 20 Zone Parameters Setup

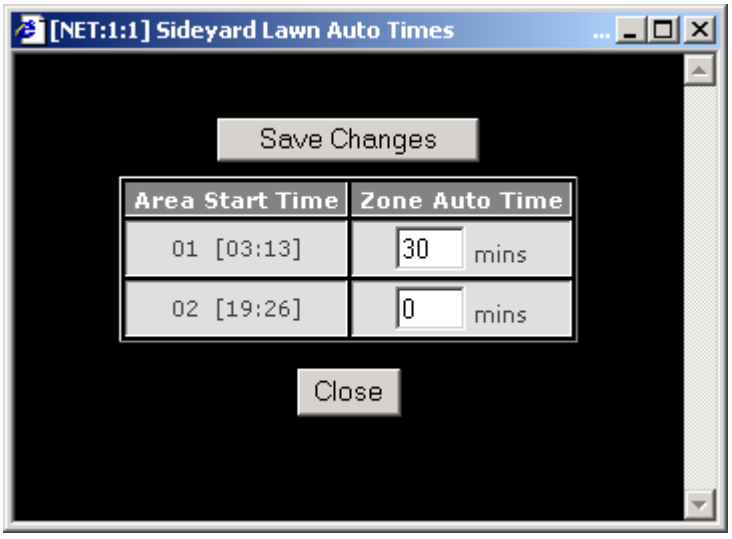


Figure 21 Zone Program Time Tailoring

4.2.6 Internet Connection and Local Area Network

An internet connection is not essential for basic operation, but features will not be available without it. Connection to the internet can be accomplished in several manners and the Windows operating system provides wizards to help achieve this objective.

McsSprinklers connects to Internet to obtain current environmental conditions from a local reporting station. This is done in both a single-PC setup and in a multiple-PC setup. When a redundant operation is

desired then the Internet connection needs to be available to all PCs on the Local Area Network. This can be achieved with a router that bridges the Internet and LAN. It can also be done with Internet Connection Sharing within the computer that has the direct or dial-up connection to the Internet.

Current weather information from the internet is available from the AWS network such is used in many local schools and reported on local new stations. It is also available from the WeatherUnderground network. This network is primarily personal weatherstions that upload to the WeatherUnderground server.

mcsSprinklers uses the standard port 80 and HTTP protocol to access external Internet locations. The zip code is used to identify local Forecast and AWS stations. The WeatherUnderground stations are identified by the their Station ID which can be obtained by using a Browser and navigating to the URL http://www.wunderground.com/weatherstation/ListStations.asp?selectedState=WA&selectedCountry=United+States. For non-USA location the navigation can be started at http://www.wunderground.com/weatherstation/ListStations.asp.

For current weather conditions a selection from one to three of these stations is made. Not all stations report reliably so more than one should be selected as backup(s). Either AWS or WeatherUnderground can be used at one time with the selection made with the radio button shown on Figure 22. If AWS is used then there is no need to enter WeatherUnderground stations. The converse is also true.

Forecast weather conditions are also obtained from the Internet using either WeatherUnderground, AccuWeather or National Weather Service. The Setup8-Weather page segment to support these selections is shown in Figure 22. For forecast information from WeatherUnderground there needs to be a free registration to obtain a license key from http://www.wunderground.com/weather/api/d/pricing.html This license key as well as a station identifier are used on the setup. The station identifier can be zip code or a variety of other means to identify. Review of the Documentation tab from the same WeatherUnderground page where the license/API key is requested for other means to identify the location. For AccuWeather the stations can be zip code internationally from the codes list in Section 11.

Many AWS or WeatherUnderground reporting stations do not contain a full suite of sensors and are able to provided only a subset of weather data. The daily rainfall is one that may not be available. To help overcome this shortfall an AWS or WeatherUnderground site can be selected to provide only rainfall information. When one is selected the rainfall will be provided by this source rather than from the other three potential sources. If desired the secondary or tertiary site can also be used for rainfall only.

It is possible that Forecast data or Weather data fails to be updated at the source site or the connection with the source site is lost. When Weather data is lost then the latest information from the Forecast site will be used. When Forecast data is lost then average values will be used to compute Evapotranspiration. The loss of either Weather or Forecast data will generate a message that can be viewed locally or will be optionally delivered via Email. The timeout threshold for this message is entered for each Weather and Forecast. A forecast site will only update hourly or less based upon licensing rules. A Weather site's update interval varies, but five minutes is typical. .

From a quality of information perspective a local weather station will provide the best set of data specific to a site. Current conditions from AWS or WU will provide the same quality of information and the selection should be based upon the proximity of the reporting station and the reliabilty of its feed. WeatherUnderground, AccuWeather or NWS provide equivalent forecast information. If NWS is used for forecast then the EPA should be used as the UV source if a local UV or ET measurements is not available. EPA is automatically used for Standard mcsSprinklers version as long as a zip code is present.

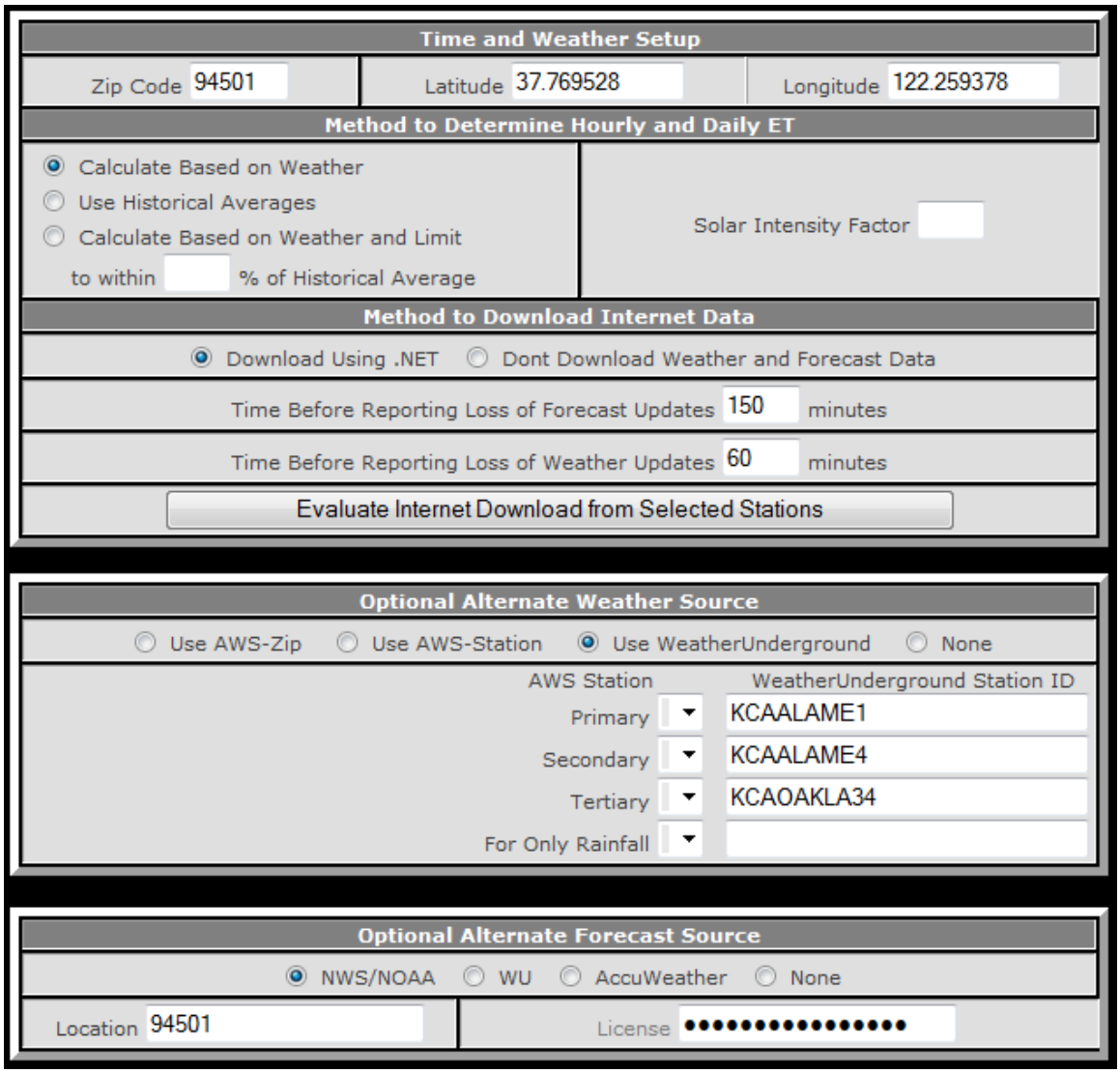


Figure 22 Weather Source Selections

Use of weather information from a local weather station is possible if a station is installed at the site. The interface mechanism available for local equipment follows a client-server model so that the local weather station can be used for multiple needs. This is either via an IP address using HTTP protocol or via the Windows File System using comma-separated-values (csv) file format.

The WeatherHawk is interfaced via its IP port. The port information needs to be entered if this weather station is to be used. The Davis Vantage Pro is interfaced via software provided by AmbientWeather.com Virtual Weather Station using the csv file mechanism provided by that software. mcsSprinklers will read the current data from the file path that is entered here on the setup.

This setup is shown in Figure 23

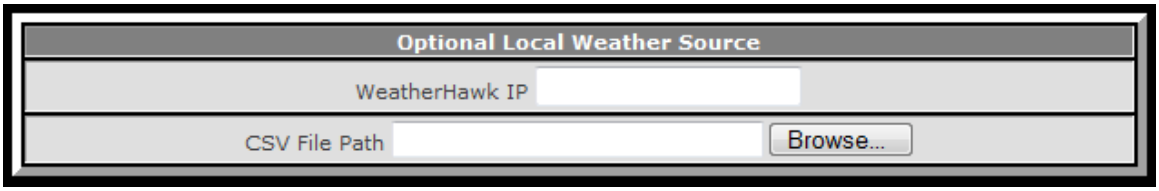
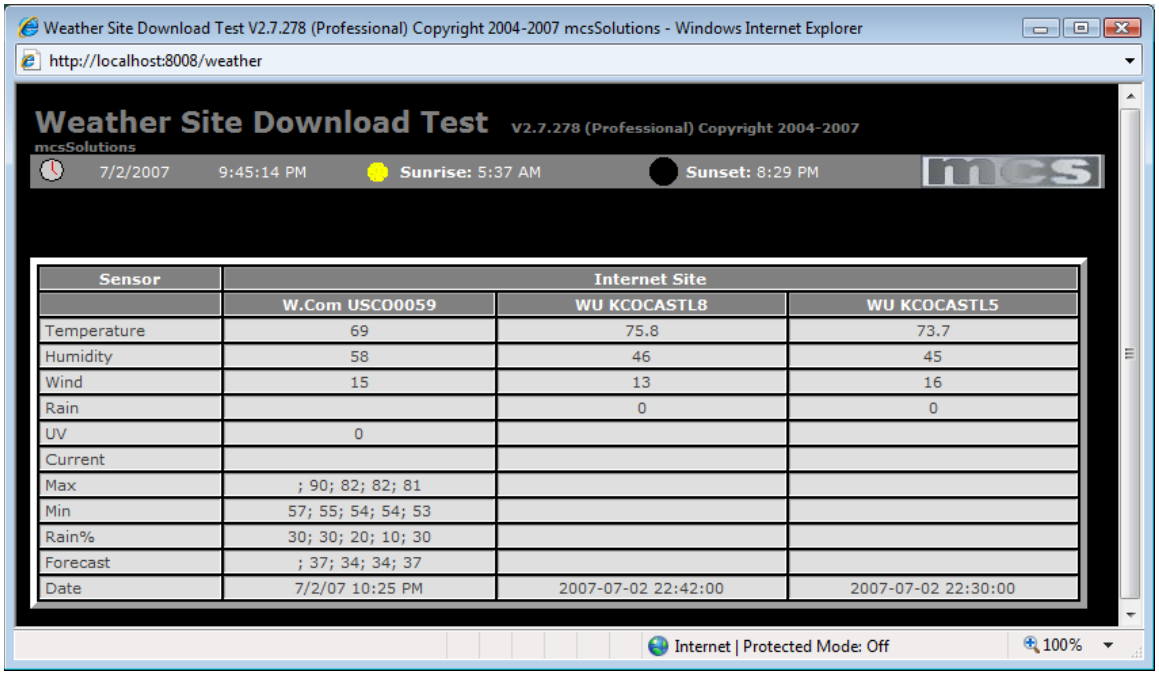


Figure 23 Local Weather Station Data Source

Once the internet weather data sources have been selected they can be tested to assure the site is operational and reasonable data is returned. The "Evaluate Internet Download from Selected Stations" button on Figure 22 is used to make an immediate query of all the sites. The results will be shown in a new page such as shown in Figure 24.


Weather Site Download Test V2.7.278 (Professional) Copyright 2004-2007 mcsSolutions - Windows Internet Explorer
http://localhost:8008/weather
Weather Site Download Test V2.7.278 (Professional) Copyright 2004-2007
mcsSolutions
7/2/2007 9:45:14 PM Sunrise: 5:37 AM Sunset: 8:29 PM
Internet | Protected Mode: Off
100%

Sensor	Internet Site		
	W.Com USCO0059	WU KCOCASTL8	WU KCOCASTL5
Temperature	69	75.8	73.7
Humidity	58	46	45
Wind	15	13	16
Rain		0	0
UV	0		
Current			
Max	; 90; 82; 82; 81		
Min	57; 55; 54; 54; 53		
Rain%	30; 30; 20; 10; 30		
Forecast	; 37; 34; 34; 37		
Date	7/2/07 10:25 PM	2007-07-02 22:42:00	2007-07-02 22:30:00

Figure 24 Weather Site Download Test

Each individual sensor can be obtained from one of the available selected sources. The default is to use the internet AWS or WU for the weather sensors, WeatherUnderground, AccuWeather or NOAA National Weather Service for the forecast sensors, and for mcsSprinklers to compute the remainder that are not available from these sources.

The ET "sensor" is important when ET-based scheduling is performed. Some local weather stations provide this as a direct measurement that can be used via xAP, Weatherhawk, Homeseer or CSV mechanisms. Internet data containing ET is not available, but can be computed from other sensor sources. These are temperature, wind, humidity and a measure of solar intensity. The solar source can be either from the Solar Radiation sensor or from the UV sensor. When selecting a computed ET don't forget to also select the source for the sensors that are used in the ET computation.

On a sensor-by-sensor basis this can be changed as shown in Figure 25 if other sources are available. In the case of xAP and Homeseer sourced sensors the selection of the specific address or device is necessary. For the others, only an indication of the source feed is necessary and mcsSprinklers will find it in the feed.

The options that are available for Weather Sensor Source will depend upon other options selected as possible sources of weather data.

When the sensor values are viewed on the General Status page there will be a grayed-out identification of the source of the sensor. This may be a weather station address or a few letters to represent the source.

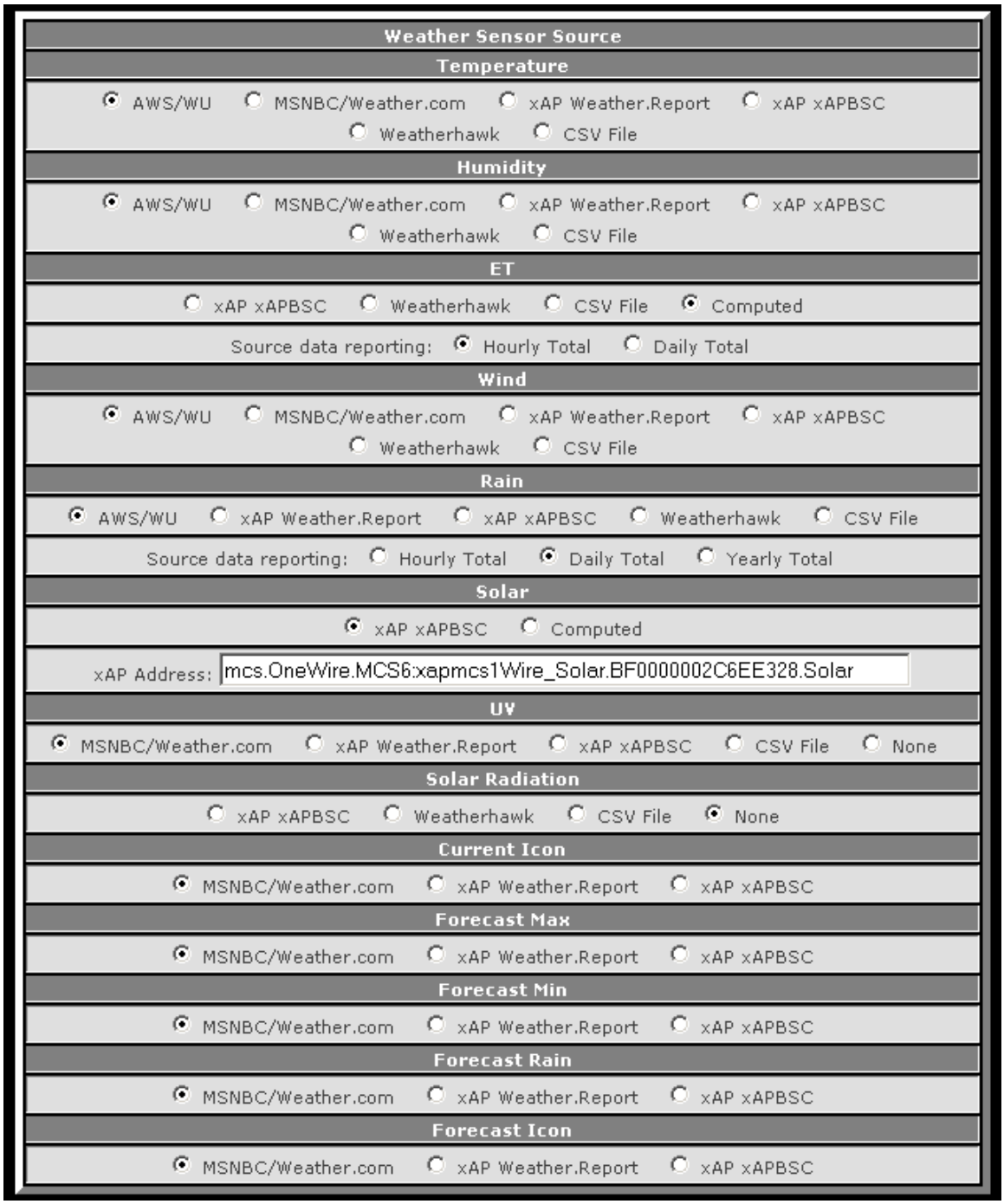


Figure 25 Individual Sensor Source Selections

McsSprinklers will also respond to browser requests from remote locations in the same manner that is responds to request from the Windows desktop of the local PC. The HTTP protocol supported by standard

browsers such as Internet Explorer or Safari continues to be used, but the port defaults to 8008 rather than 80. This is to prevent contention with other potential servers on the local PC and to provide a degree of security since hackers focus on breaching port 80. When configured for operation with Homeseer it is also possible to utilize the Homeseer server for this purpose. In this case the selection of the server in Figure 26 is just the Homeseer radio button as compared to both the internal radio button and port number.

This port number can be changed if necessary from the Setup9-Others page as shown in Figure 26.

Figure 26 Port Selections for Remote Access

The browser interface to the setup of the various mcsSprinkler pages provides context-sensitive help. As the mouse hovers over the darker header banner of any group a popup tooltip will appear to the right of the mouse to provide information on the setup of that section. As the user becomes more familiar with the setup procedures this popup can be disabled with the setup setting on Setup9-Others page as shown in Figure 27.

The Expert Mode setting, also on Figure 27, is used to toggle between presentation of the setup based upon the interview answers vs. showing all possible setup options. When the interview is completed then the setup pages will only show those settings applicable to the hardware configuration and software options selected. When the interview has not been started or is incomplete then many setup options will not be visible unless the Expert Mode checkbox is set.

Data can be collected to capture internal logic decisions to help investigate unexpected behaviors. When enabled, with "Produce Debug Data Files" checkbox a debug text file will be created for each new start of mcsSprinklers and at the start of each day. The amount of data collected can be limited, and should be limited, on embedded platforms, by indicating the maximum size of the folder for the debug files. When this threshold is reached then older files are removed. A selected debug file can be emailed if email has been setup or it can be individually selected with right-click hyperlink on the filename. The date in the filename and the Last Modified date can be used to identify the period of time a particular debug file has collected data. If the most current debug file is to be used for analysis then it should first be flushed and closed using the "Write Current Debug Data File" button.

If debug data is not going to be collected locally then a specific path can be specified. In this case the visibility of the content is not available for email etc. Direct means to access the specified folder will be needed to use the collected data.

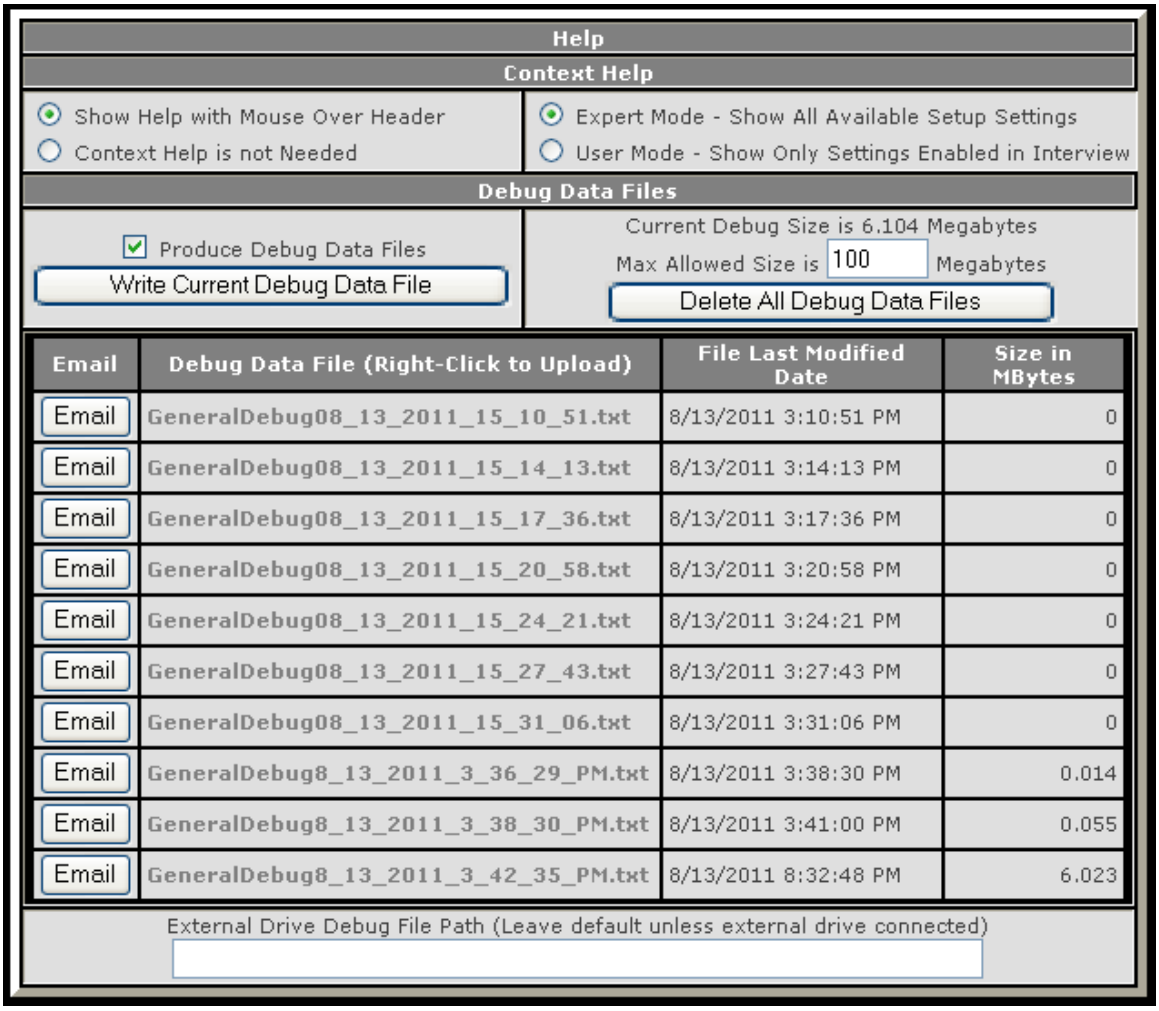

Help
Context Help
Show Help with Mouse Over Header
Context Help is not Needed
Expert Mode - Show All Available Setup Settings
User Mode - Show Only Settings Enabled in Interview
Debug Data Files
Produce Debug Data Files
Write Current Debug Data File
Current Debug Size is 6.104 Megabytes
Max Allowed Size is 100 Megabytes
Delete All Debug Data Files
Email
Debug Data File (Right-Click to Upload)
File Last Modified Date
Size in MBytes
Email GeneralDebug08_13_2011_15_10_51.txt 8/13/2011 3:10:51 PM 0
Email GeneralDebug08_13_2011_15_14_13.txt 8/13/2011 3:14:13 PM 0
Email GeneralDebug08_13_2011_15_17_36.txt 8/13/2011 3:17:36 PM 0
Email GeneralDebug08_13_2011_15_20_58.txt 8/13/2011 3:20:58 PM 0
Email GeneralDebug08_13_2011_15_24_21.txt 8/13/2011 3:24:21 PM 0
Email GeneralDebug08_13_2011_15_27_43.txt 8/13/2011 3:27:43 PM 0
Email GeneralDebug08_13_2011_15_31_06.txt 8/13/2011 3:31:06 PM 0
Email GeneralDebug8_13_2011_3_36_29_PM.txt 8/13/2011 3:38:30 PM 0.014
Email GeneralDebug8_13_2011_3_38_30_PM.txt 8/13/2011 3:41:00 PM 0.055
Email GeneralDebug8_13_2011_3_42_35_PM.txt 8/13/2011 8:32:48 PM 6.023
External Drive Debug File Path (Leave default unless external drive connected)

Figure 27 Help Setup Options

Even when context help has been disabled the full help features of this manual are available with the Help that can be accessed from the links at the top of each setup page. See Figure 28.

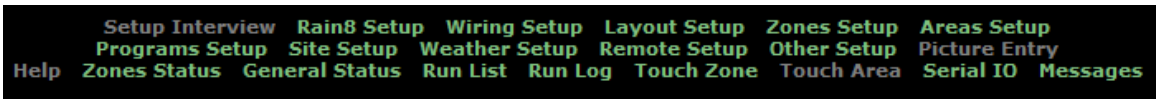

Setup Interview Rain8 Setup Wiring Setup Layout Setup Zones Setup Areas Setup
Programs Setup Site Setup Weather Setup Remote Setup Other Setup Picture Entry
Help Zones Status General Status Run List Run Log Touch Zone Touch Area Serial IO Messages

Figure 28 Browser Links to Help and Other Pages

[Version-Dependent Capability] Six interface applications are provided to allow these interfaces to be supported outside of the core mcsSprinklers scheduler. This becomes significant in redundant architectures so individual nodes can be managed with minimum operational interdependencies. When configured for redundant operation the interfaces should be run as independent nodes rather than as part of mcsSprinklers. This implies that the prior setup of the Wireless and Power line interfaces should be configured for xap/external rather than internal. See Figure 9.

4.2.7 External Application Interface

4.2.7.1 xAP

[Version-Dependent Capability] xAP is used as the primary external interface to mcsSprinklers. It is the mechanism to allow redundant operation over multiple host computers to achieve increased availability of the irrigation control function. When used in a single computer configuration xAP is still available to obtain information and control mcsSprinklers.

The first reference to xAP is on the Rain8 setup page shown in Figure 9. If the power line or wireless interface can be better placed close to the valves under control rather than at the controlling computer then remote xAP nodes for these interfaces can be running at other computers and controlled via xAP messaging. The x10 schema is used in this scenario.

mcsSprinklers has the abiltiy to launch these independent interface nodes upon its startup. They can be selected individually, but in a general configuration they will be either all enabled at startup or all not used. The Setup9-Others page contains this user selection as shown in Figure 29.

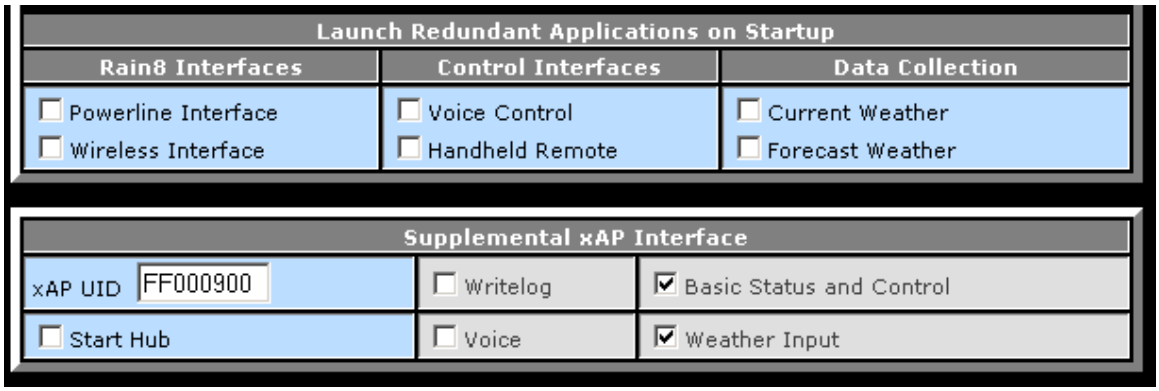


Figure 29 Launch of Interface Nodes and xAP Message Selection

The redundant architecture option provides a means to assure maximum availability of the control function. A second aspect of assured operation is command redundancy and safety provisions. The timeout safety was previously shown in Figure 8. It provides the safety against excessive water delivery at the point of the Rain8 module. Within the PC, OFF commands can be delivered at times when a zone is not being watered. These can be setup to be hourly and/or daily. Setup options are also available to repeat any ON or OFF command to assure that the command is received by the Rain8. In the case of the Rain8-Net module there exists a two-way interface so the PC always obtains positive status of the state of the valves and the need for special safety provision are reduced. The Rain8-Wireless and Rain8-Power line have no mechanism to report valve status back to the PC so command redundancy is a good idea. These safety setups are performed on the Setup6-Site page as shown in Figure 41.

Other xAP applications can interact with mcsSprinklers using the messaging providing in the Supplemental xAP Interface section. Valves can be controlled and checked for status with BSC schema. Error reporting from mcsSprinklers can be done with the Homeseer.Event/Event.log schema. Historical information that is normally recorded by mcsSprinklers can also be made available for external database or other uses through reporting with BSC schema. [Version Dependent} Centralized configuration setup can be accomplished with the Homeseer.Config schema. Remote audio and speech recognition is done with the Voice schema.

mcsSprinklers will listen for BSC events and info messages that have been setup as the source of its information. For example, the external inhibit (UID=09) will be seen as a xapbsc.event or xapbsc.info message with a target unspecified or specified to be mcsSprinklers. The ON/OFF state value in this message will control the external inhibit function. The reminder of the xapbsc.event or xapbsc.info

messages will use either the Text or Level key to update the value conveyed in the message. An example may be a wind speed measurement made with a local sensor rather than one obtained from the AWS internet site.

There is also a set of xapbcs.cmd messages that can be used to control mcsSprinklers actions much like the buttons that control it from the General Status page. A button on the General Status page will also respond to a xapbsc.cmd message with an ON/OFF control. The UID for these controls can be seen from the xAP Reporting page as shown in Figure 30

Each of these message schemas for the indicated purpose can be enabled or disabled selectively. When other xAP applications are present on the same computer then a xAP hub must run. If no others are being used the mcsSprinklers can launch one. xAP also requires unique IDs for each xAP node so the ID is made configurable so no conflict will occur.

When the Basic Status and Control is selected then an additional browser link is provided that allows the selection of which devices will report when its state changes and of these which will set the database key to allow xap-enabled databases to maintain the history of the device. This page is shown in Figure 30.

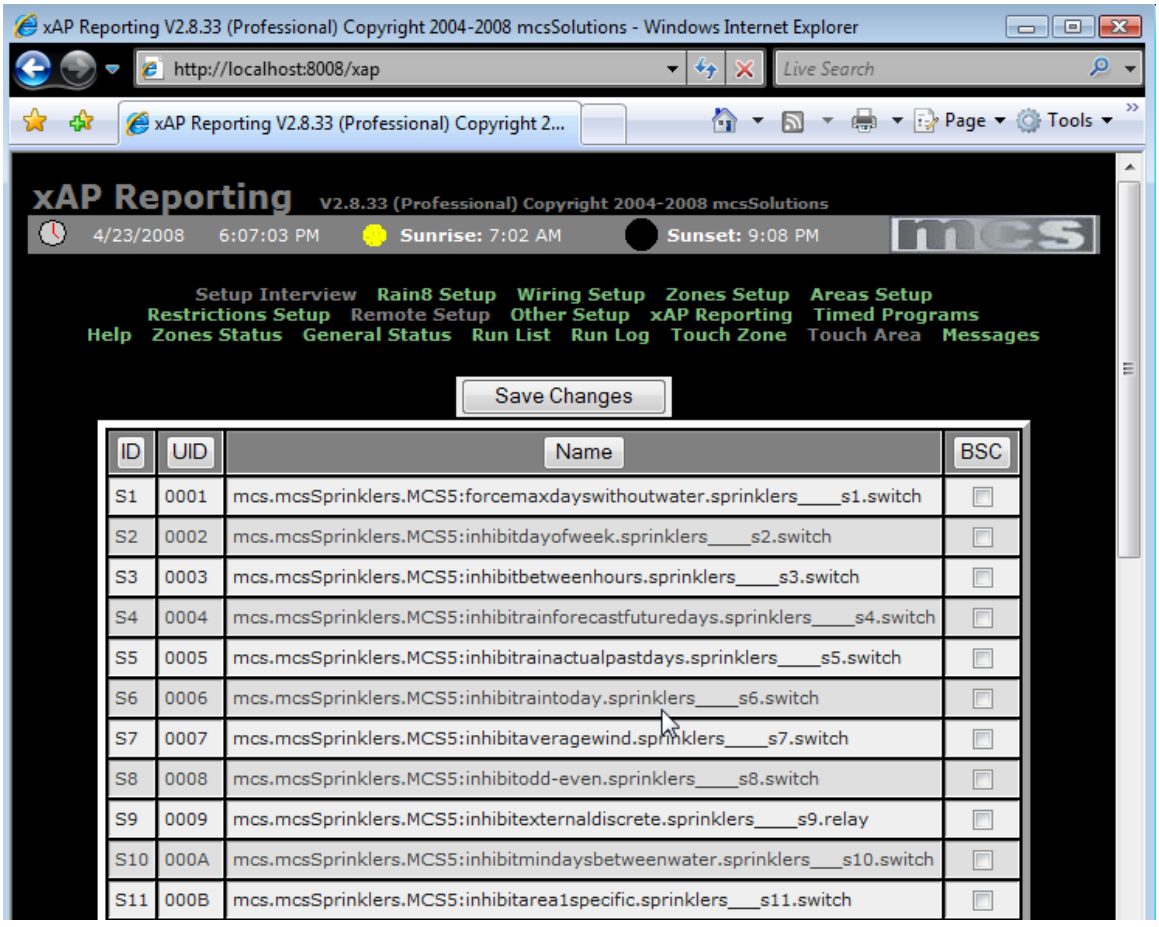

xAP Reporting V2.8.33 (Professional) Copyright 2004-2008 mcsSolutions - Windows Internet Explorer
http://localhost:8008/xap
Live Search
xAP Reporting V2.8.33 (Professional) Copyright 2...
Page
Tools
xAP Reporting
V2.8.33 (Professional) Copyright 2004-2008 mcsSolutions
4/23/2008 6:07:03 PM
Sunrise: 7:02 AM
Sunset: 9:08 PM
mcs
Setup Interview Rain8 Setup Wiring Setup Zones Setup Areas Setup
Restrictions Setup Remote Setup Other Setup xAP Reporting Timed Programs
Help Zones Status General Status Run List Run Log Touch Zone Touch Area Messages
Save Changes
ID UID Name BSC
S1 0001 mcs.mcsSprinklers.MCS5:forcemaxdayswithoutwater.sprinklers____s1.switch
S2 0002 mcs.mcsSprinklers.MCS5:inhibitdayofweek.sprinklers____s2.switch
S3 0003 mcs.mcsSprinklers.MCS5:inhibitbetweenhours.sprinklers____s3.switch
S4 0004 mcs.mcsSprinklers.MCS5:inhibitrainforecastfuturedays.sprinklers____s4.switch
S5 0005 mcs.mcsSprinklers.MCS5:inhibitrainactualpastdays.sprinklers____s5.switch
S6 0006 mcs.mcsSprinklers.MCS5:inhibitraintoday.sprinklers____s6.switch
S7 0007 mcs.mcsSprinklers.MCS5:inhibitaveragewind.sprinklers____s7.switch
S8 0008 mcs.mcsSprinklers.MCS5:inhibitodd-even.sprinklers____s8.switch
S9 0009 mcs.mcsSprinklers.MCS5:inhibitexternaldiscrete.sprinklers____s9.relay
S10 000A mcs.mcsSprinklers.MCS5:inhibitmindaysbetweenwater.sprinklers___s10.switch
S11 000B mcs.mcsSprinklers.MCS5:inhibitarea1specific.sprinklers___s11.switch

Figure 30 xAP Reporting Device Selection

Additional specification for the xAP environment is also contained on the Other Page. In this case a set of local sensors rather than internet sensors can be specified as a xAP source per Figure 25. These setup features also provide for special control device and database options. These are shown in Figure 31.

Notification specified will result in xAP event messages before an area's watering starts or a record of Rain8-Net actions. The Display options will control how the browser status information is displayed and the content of the xapbsc Display Text key. The database will default to Microsoft Access, but if MS SQL Server is available then it may be used. Normally when SQL is used, the database entry is left blank so the default server will be used.

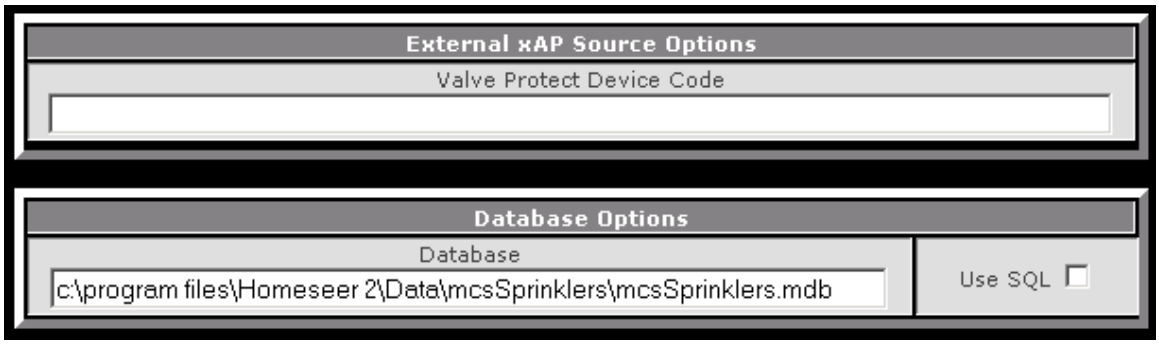


Figure 31 xAP Environment Options

4.2.7.2 Homeseer

The interface to Homeseer is customized with virtual devices, browser display, and various other options. The virtual devices are used to identify valves, pumps, restrict watering cycles, and control moding. The Browser interface can be tailored for display characteristics that will yield similar properties to other Homeseer pages. The valve and pump devices are identified in the Setup1-Rain8/Devices page as shown in Figure 16. The restrictions interface on the Setup6-Site page as shown in Figure 45. The other interface parameters are on the Setup9-Other page as shown in Figure 32.

mcsSprinklers normally obtains sensor information from its internet connection that is setup on the Weather Setup page. This can be superseded with data from Homeseer Virtual Device Strings. When a device code is entered into the section "HomeSeer Sourced Sensors" then the data will come from the Device String and data received for the specific sensor from the Internet will be ignored. When a "Solar DC" is specified then a second entry "Solar Factor" can be used to scale the sensor value for compatibility. The default value is 1.0.

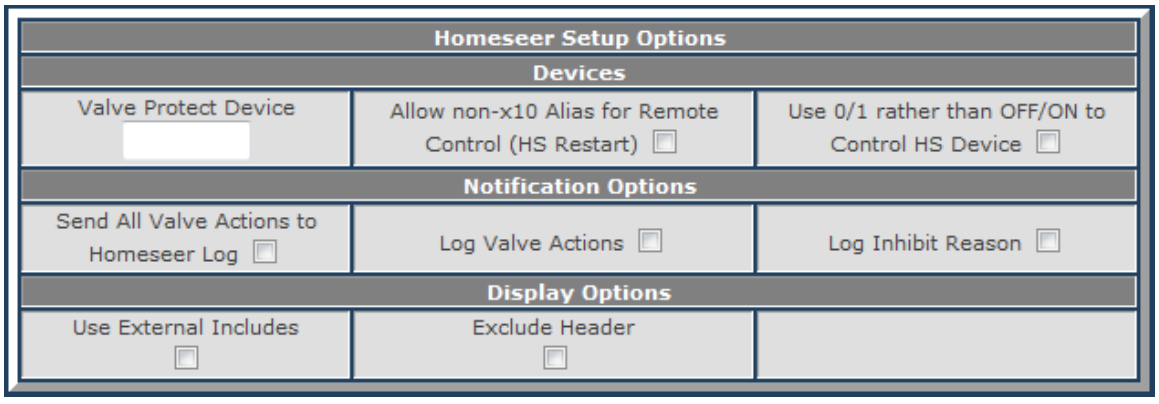


Figure 32 Homeseer Interface Options

5 Automated Control Strategy

5.1 Control Based upon Time vs. Soil Moisture Content

Traditional irrigation controllers determine when to initiate a cycle based upon some elapsed time since the last time the cycle was run. This may be something like every three days or Monday, Wednesday, and Friday. These controls also consider time of day so it may be possible to irrigate at 6 AM and 7 PM on the same day.

The duration between irrigation cycles is selected so that the soil does not become excessively dry. In peak summer times this will be more often than in the spring and fall periods. Heat waves and cool periods also occur during the seasons and these tend to result in soil moisture that is dryer than desired and irrigation at times when the foliage does not require additional water. The timed programs can be adjusted to deal with these variations or left unchanged and allow the plants to be exposed to the stress. The third choice is to allow the controller determine the next irrigation cycle based upon the soil moisture content rather than based upon some time interval.

mcsSprinklers provides the flexibility to allow either a time-based control or a moisture-based control or a combination of both. For time-based control the interval can be determined either based upon the weekly calendar or upon a daily interval. The start time during the day can be specified. Actually up to 24 different start times can be entered to spread out the irrigation over the day. Each of these start times is called a Program so up to 24 programs can be run.

Each Program can control multiple zones during an irrigation cycle. The time each zone is ON during the cycle can be changed on a Program-to-Program basis. For example, two Programs can be defined where the first runs at 6 AM and three zones are each run for 20 minutes. The second runs at 3 PM and only runs one of the three zones for 10 minutes to provide supplemental water to a part of the site that has high sun exposure.

The setup of the Timed Program Control can be done in either of two ways. One is from the Timed Programs selection from the menu. This will show a grid where each zone is listed in the rows and each Program time is listed in the columns. See Figure 33.

Area 1 Program Times	1 10:00	2 11:00	3 12:00	4 17:00	5
Zone Auto Time	Mins	Mins	Mins	Mins	Mins
[NET 1 Valve 1] Front Lawn	15	15	0	15	
[NET 1 Valve 2] Front Shrubs	5	5	0	5	
[NET 1 Valve 3] Back Lawn	5	5	0	5	
[NET 1 Valve 4] Side Lawn	5	5	0	5	
[NET 1 Valve 5] Herbs	3	3	3	3	

Figure 33 Timed Programs Setup Matrix

In the example shown in Figure 33 there are four Programs defined and a blank column where the next program can be entered. There are five zones in each Program. At 10 AM a cycle will start where the Front Lawn will be ON for 15 minutes, then the Front Shrubs will be ON for 5 minutes, etc. Another cycle

will start at 11 AM. A third will start at 12 Noon and this cycle will only turn ON the Herbs zone for 3 minutes. The last Program of the day will run at 5 PM.

The selection of the days when these programs will run is done on the Area Setup page per the Control Strategy where the Control Strategy is Day-Of-Week, Even-Odd, or Interval. The Measured and ET Calculated control strategies do not have Timed Programs since their cycle start times are a function of soil moisture rather than time.

The selection of zones for the Programs is done in the Zone Setup page where the zones that have been defined in the Wiring Page are mapped into specific Areas. For the purpose of understanding the Timed Programs, an Area can be thought of as an independent control box. Since each of eight Areas can have an independent control strategy and 24 Programs can be defined for each Area, there is a total of 8x24=184 Programs available.

Setup and editing of aspects of the Timed Programs can also be done from the Area, Zone, and Zone Status pages. The Area page provides the mechanism to add and change Program start times. See Figure 40. The durations for a zone for each of its programs can be edited from the popup that is produced by clicking the clock icon for the zone on the Zone Setup or Zone Status page. See Figure 21. Times can be entered in integer format for whole minute durations. If resolution to the second is desired then the durations should be entered in the format mm:ss.

5.2 Watering Duration and Interval

The intention of an automated control strategy is to provide appropriate amounts of water at appropriate times to maintain adequate soil moisture over a given area. In a basic situation this objective can be achieved by applying a set amount of water at regular intervals. In more sophisticated situations this objective is achieved by applying water when the soil moisture content becomes sufficiently low. In both of these situations there may be overriding considerations such as local water conservation regulations that limit when water can be used for irrigation.

The basic automation is achieved using a control model similar to standard timer-based sprinkler controllers. These controllers can be setup to water a zone on a regular interval or on a specific set of days of a week. The timed controller will enable cycling of typically four to twelve zones in sequence. Multiple controllers can be used to satisfy the needs of multiple distribution areas.

In a fixed-time / fixed-interval strategy the amount of water delivered is independent of the environmental conditions that drive the actual amount of water that is needed to maintain the desired soil moisture level. Hot-sunny days will extract more moisture from the plants and soil than cool-cloudy days. Wind also has a contributory effect on moisture loss and the need for replacement of this loss.

The amount of water actually needed is a function of several parameters. The primary factors are moisture loss, soil quality, foliage type, and efficiency of the sprinkler head distribution. All of these factors except moisture loss are known at the time that irrigation valves and sprinkler heads are installed. The moisture loss changes continuously based upon rainfall, solar radiation, temperature, wind speed, and some other less-dominant factors. The moisture loss is generally characterized as Evapotranspiration.

The general watering requirement can be algorithmically described as

$$V = (Et_o \times K_c \times K_d \times K_s \times F_r - P_r)$$

Where $\mathbf{Et_o}$ = Evapotranspiration
$\mathbf{K_c}$ = Foliage characteristic
$\mathbf{K_d}$ = Distribution efficiency
$\mathbf{K_s}$ = Soil porosity

$\mathbf{F_r}$ = Flow rate
$\mathbf{P_r}$ = Precipitation rate
$\mathbf{V}$ = Volume of water required

It is generally the intention to encourage the foliage roots to penetrate lower into the soil so they will have a strong footing and be less sensitive to surface variation in moisture. This means that the objective of the irrigation controller is to deliver moisture to a desired soil depth. This depth is achieved with traditional installations by saturating the surface with a sufficient volume of water that it will soak down to the desired level. This implies that water delivery will be in bursts rather than a continuous misting.

$\mathbf{K_c}$ Foliage characteristic, $\mathbf{K_e}$ Distribution efficiency, $\mathbf{K_s}$ Soil porosity, and $\mathbf{F_r}$ Flow rate are factors for which information is not readily available on an installation-by-installation basis. What is available, however, is an approximation based upon experience, of how long a specific zone should be watered to saturate the soil to the desired depth. This means the installer simply is required to provide the zone watering duration and the controller can determine when to activate a watering cycle based upon the following formula:

$$I = \frac{1}{(Et_o \times K_e - P_r)}$$

Where $\mathbf{Et_o}$ = Evapotranspiration
$\mathbf{K_e}$ = Efficiency of moisture retention
$\mathbf{P_r}$ = Precipitation rate
$\mathbf{I}$ = Days per watering cycle

The $\mathbf{Et_o}$ Evapotranspiration and $\mathbf{P_r}$ Precipitation rate can be determined from weather data from a nearby weather reporting station and this data is available in real-time over the Internet. $\mathbf{K_e}$ Efficiency of moisture retention is available as a tweaking factor should some adjustments be necessary for off-nominal conditions.

mcsSprinklers provides a factor that can be used to adjust $\mathbf{K_e}$, which is the Soil Factor. Smaller values of Soil Factor will result in more frequent watering cycles. The default values for this factor is 0.75.

In a traditional timer-based controller both the interval and duration of watering are setup at time of installation. With the ability to adjust to changing environmental conditions the interval can be dynamically changed and unnecessary watering cycles avoided.

This same benefit can be achieved with use of moisture probes. Actual measurements of the moisture content are made when a dryness threshold is reached and a watering cycle is scheduled. While this does have the advantage of a more positive measurement it also has two downsides. The first is that moisture sensors require additional hardware to be installed. The second is that moisture flow patterns in soil tend to change over time so moisture at a strategically placed sensor will change over time, yet the watering needs for the area will remain consistent.

The ET can be used to determine the frequency of watering. Each watering cycle will be a specified number of minutes. The following information from http://www.washoeet.dri.edu/preciprates.html provides a good aid in determining the duration.

5.2.1 Gross Estimated Runtimes for Small to Medium Turf Areas

Bill Carlos, Horticulturist, University of Nevada Cooperative Extension
John C. Guitjens Ph.D., Prof, Environmental Resource Science, University of Nevada College of Agriculture

The following suggested sprinkle runtimes and irrigation rates are for residential turf areas. Site specific runtimes will vary because of lawn shape and slope, nozzle size, and sprinkler head spacing. Runtimes are based on the manufacturer information and names of products are used for illustration purposes only. The impact rotor runtimes are longer because of a larger radius and, therefore, a larger area, and a smaller delivery rate.

Small Lawn Areas
Pop-up Toro 570
is based on 30 pounds per square inch (psi) of water pressure, a delivery rate of 3.60 gallons per minute (gpm) for a full circle nozzle, a sprinkler head of 15 ft, a spray radius of 15ft, and matched precipitation rates (MPR).
Please note: run times will vary with ET rates.

Runtime calculation

Reference Evapotranspiration = Eto=0.35 inches per day = 0.029 ft per day of water depth

- Assume an irrigation efficiency = 85% (=0.85)
- The area used here is square and the sprinkler head spacing 15 ft x 15 ft = 225 ft^2
- The conversion of cubic feet to gallons = 7.48 gal/ft^3
- 0.029 ft/0.85 irrigation efficiency =0.034 ft of water application depth
- 0.034 ft x 225 ft2 = 7.65 ft^3
- 7.65 ft3 x 7.48 gal/ ft3 = 57.2 gal
- 57.2 gal/3.60 gal/minute = 15.9 minutes per day (approx. 16 minutes per day)

Medium Lawn Area
RainBird Mini Paw, Impact Rotor Pop-Up Sprinkler
is based on 25 psi, a delivery rate of 2.60 gpm for a full circle rotor, a sprinkler spacing of 20ft, and a spray radius of 20 ft.

Runtime calculation:

Reference Evapotranspiration = Eto=0.35 inches per day = 0.029 ft per day of water depth

- Assume an irrigation efficiency = 85% (=0.85)
- The area used here is square and the sprinkler head spacing 20 ft x 20 ft

= 400 ft^2

- The conversion of cubic feet to gallons = 7.48 gal/ft^3
- 0.029 ft/0.85 irrigation efficiency =0.034 ft of water application depth
- 0.034 ft x 400 ft2 = 13.6 ft^3
- 13.6 ft3 x 7.48 gal/ ft^3 = 102 gal
- 102 gal/2.60 gal/minute = 39 minutes per day

Medium Turf Areas

Toro 340 Series Stream Rotors

is based on 35 psi, a delivery rate of 3.10 gpm for a full circle rotor, a sprinkler spacing of 15ft, and a spray radius of 15 ft.

Runtime calculation:

Reference Evapotranspiration = Eto=0.35 inches per day = 0.029 ft per day of water depth

- Assume an irrigation efficiency = 85% (=0.85)
- The area used here is square and the sprinkler head spacing 15 ft x 15 ft = 225 ft^2
- The conversion of cubic feet to gallons = 7.48 gal/ft^3
- 0.029 ft/0.85 irrigation efficiency =0.034 ft of water application depth
- 0.034 ft x 225 ft2 = 7.65 ft^3
- 7.65 ft3 x 7.48 gal/ ft^3 = 57.2 gal
- 57.2 gal/3.10 gal/minute = 18.5 minutes per day (approx. 20 minutes per day)

Reference:

Rain Bird. 1999-2000 Catalog. Landscape Irrigation Products

Toro. 2000-2001, Irrigation Product Catalog

The watering schedule is setup in mcsSprinklers on the Setup4-Zones and Setup5-Areas setup pages. A Zone represents the set of sprinkler heads that are controlled by a single valve. An Area represents a set of zones that use the same watering schedule. mcsSprinklers supports multiple zones within an Area and multiple areas. Zones within an area are scheduled in sequence and in the order used in the Setup4-Zones setup page. Areas are scheduled in parallel, but this can be changed to sequential with a checkbox setting on the Setup5-Areas setup page under Zone Sequence Control. Sequential Area would be used when you have insufficient water pressure to run 2 areas at the same time.

The setup of a zone for automatic watering requires two user inputs. One is the time that a zone should remain on when started and the second is the efficiency factor. These are the **I** and $\mathbf{K_e}$ from the equation above.

The setup of an area's watering schedule includes the type of strategy, start time preferences, and water supply considerations. Five strategies are available. Three are timed and two are based upon soil moisture. The "Calculated ET" strategy determines moisture content based upon **Et_o** and the "Measured" strategy determines moisture content based upon a moisture sensor probe. Entries are available for moisture content thresholds that will trigger the start of a new cycle. A value of 0 is reasonable for a calculated threshold while the value for the probe will depend upon the interface parameters of the probe.

The "Calculated ET" strategy depends upon sensor input to perform the hourly calculation of ET. These sensors can come from local sources or the internet. Since sensor data is not 100% reliable mcsSprinklers provides some options for how ET is determined. These are selected on the Other Setup page as shown in Figure 22 under Method to Determine Hourly and Daily ET. When reliable data is available then the option to Calculate based on Weather is the appropriate selection. When data is not available or reliability is poor then use of the historical averages are best. When data is essentially good, but some protection for bad data is desired then the third option to provide a limit on ET is used. In this case the weather sensor data will be used for the ET calculation, but when the ET varies from the historical average then it will be limited. For example, if a 50% limit is used and the historical hourly ET is 0.001 inch, then the computed ET value for the hour will be no less than 0.0005 and no more than 0.0015.

Every minute mcsSprinklers estimates the soil moisture content based upon current measurements or the ET which is calculated hourly. These measurements are rainfall, solar radiation, temperature, and wind from the Internet and moisture probe if it is available. mcsSprinklers also contains a monthly total ET database. A linear interpolation based upon the day between two months to get the expected daily ET. The integral under the hourly ET curve for the day will be the expected daily ET. A triangle function is used that starts at sunrise and stops at sunset with the peak at solar noon and then pick off the hourly ET valves from the slope of this triangle. The use of the ET from the weather calculation, from the historical database or from a blend of the two is a user option on the Other Setup page. When the two calculation methods are blended the historical calculation forms a limit band with a user-specified tolerance. Current calculations will allow the ET to vary within this band, but not vary beyond it. The General Status page display of the Hourly ET value will show (CALC) or (LIMITED) depending upon the current calculation being inside or outside the historical tolerance band.

The soil moisture calculation for a zone is suspended when a zone's sprinkler valve is turned on. During this watering period the estimated moisture content is proportionately increased until the watering is completed with a resultant moisture level of 100% (1.0). This soil moisture level is available for viewing on the Zone Status page and is available for use in one of the two soil-moisture control strategies.

mcsSprinklers contains a monthly total ET database. A linear interpolation based upon the day between two months to get the expected daily ET. The integral under the hourly ET curve for the day will be the expected daily ET. A triangle function that starts at sunrise and stops at sunset with the peak at solar noon and then pick off the hourly ET valves from the slope of this triangle.

The setup of the automatic control strategy is done on Setup5-Areas page. A non-editable section is at the top of the area that shows the zones that have been assigned to the area. This is shown in Figure 34.

Zones in Area 1 (Sideyard Lawn)	
[X10 H Valve 2] Sideyard Pond (H2)	[X10 H Valve 3] Sideyard Stream (H3)
[X10 H Valve 5] Sideyard Rock East (H5)	[X10 H Valve 6] Sideyard Rock West (H6)
[X10 H Valve 8] Sideyard House Bed (H8)	

Figure 34 Zone Moisture Trends in Area

The zone identification contains all information about the zone that has been previously entered. The graphic is an aide to see the rates of moisture loss that are calculated based upon the zone soil and rain efficiency factors as well as the Area's min threshold when using the calculated control strategy.

Selection of one of the five strategies for any Area that will be used is required and when selected any additional entries under it are needed. The first three are time-based strategies which are the traditional modes for irrigation control. The last two are based upon the foliage's need for water which is either measured or calculated based upon Evapotranspiration. This setup is shown in Figure 35.

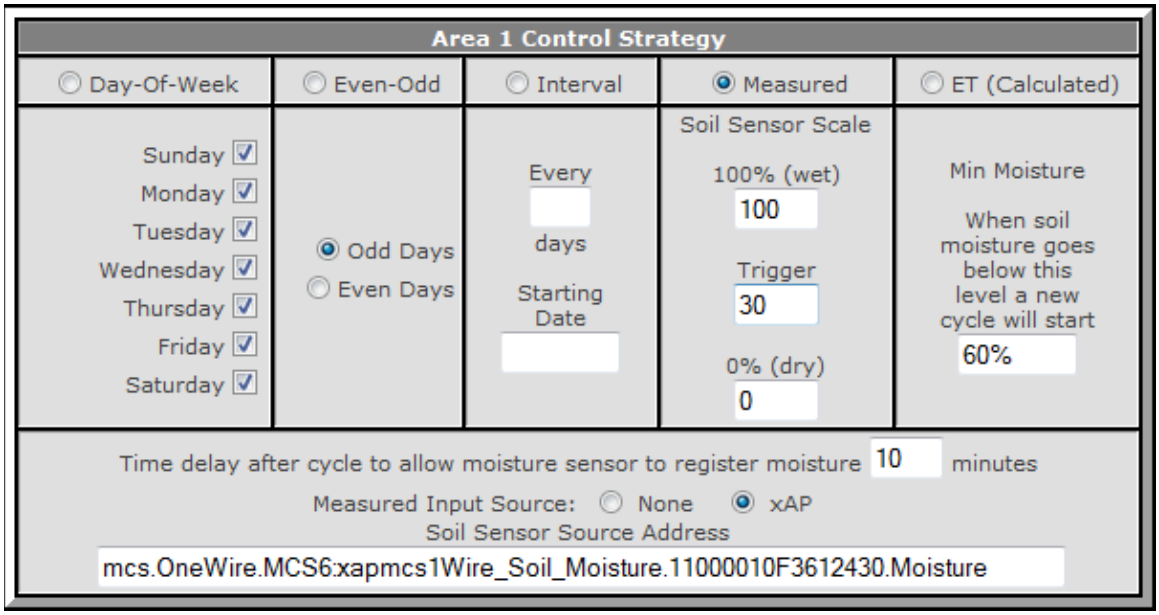


Figure 35 Area Control Strategy Selections

Sequence control will usually be set so that only one zone at the site is running at a time. This is the situation because of limited water pressure availability. If pressure is adequate for more than a single zone then the default of one zone at a time can be increased. This can be done by either identifying the number of zones that can be running at the same time or it can be done by identifying the flow rate that can be supported. In the latter case mcsSprinklers will use the zone by zone flow rates setup on the Zone Setup Page to schedule the zones to come as close to using the available flow capacity. In the case of pump-driven areas it is usually an advantage to keep the pump running rather than having it cycle. The sequence controls for zones part of a single master sequence with simultaneous zone per site are used for this selection. The other options are described in paragraph 10.5.3 and the setup is shown in Figure 36

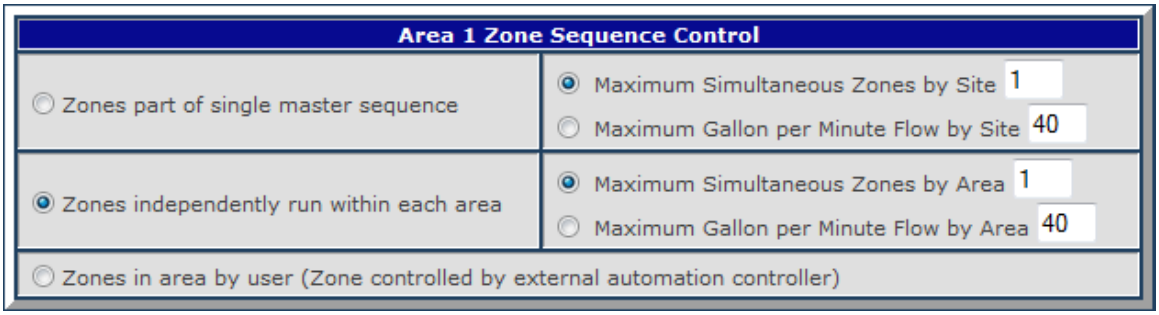

Area 1 Zone Sequence Control
Zones part of single master sequence
Maximum Simultaneous Zones by Site 1
Maximum Gallon per Minute Flow by Site 40
Zones independently run within each area
Maximum Simultaneous Zones by Area 1
Maximum Gallon per Minute Flow by Area 40
Zones in area by user (Zone controlled by external automation controller)

Figure 36 Zone - Area Sequence Control Selections

Two forms of altering the normal back-to-back auto-mode scheduling of zones are provided. One is round-robin control where the total time for all zones in an Area is modulated based upon the round-robin

settings. If two round-robin cycles are selected then the zones in the area will be turn ON and OFF two times with the run time for the zone split evenly between the two cycles. An additional delay at the end of the Area's cycle can also be specified to give additional time before the next cycles is started.

The other alteration is by inserting a fixed delay between when one zone completes and the next starts. This may be used if the water supply needs time to recharge. The delay setup entries are made in the section shown in Figure 37.

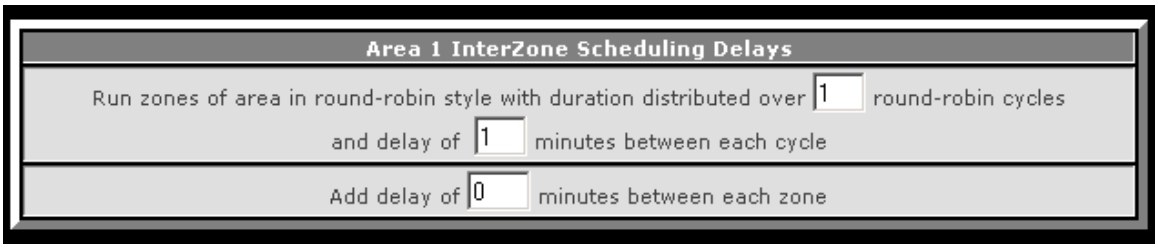

Area 1 InterZone Scheduling Delays
Run zones of area in round-robin style with duration distributed over 1 round-robin cycles
and delay of 1 minutes between each cycle
Add delay of 0 minutes between each zone

Figure 37 Zone - Area Scheduling Delays

The pump entry is optional, but if a pump is involved then the control valve for this area's zones needs to be identified with the pull down. If it is wired such that control voltage will turn it ON, then Enable=on should be selected. The Enable=off is used for inverse control.

If some form of holding tank, lake or well is used that has limited capacity then the discharge interval and recharge interval can be specified. When the run time or recharge times are exceeded the area will be inhibited and an Area inhibit notification will be provided.

If the ability exists to measure water usage while the Area has zones active then the source for the water meter measurement can be entered. mcsSprinklers will read the meter as it controls zones and will then make this information available on the General Status and Calendar views. The pump and water flow metering setup is shown in Figure 38.

The monitoring of water use, when a meter is used, can be done by monitoring for an absolute daily amount that is setup on the Zone Setup page or by monitoring exceeding an average that has been experienced in the recent past. The averaging approach is setup as shown in Figure 38 where the duration of the average is specified and the percentage over this average that will produce a message and possible email if setup.

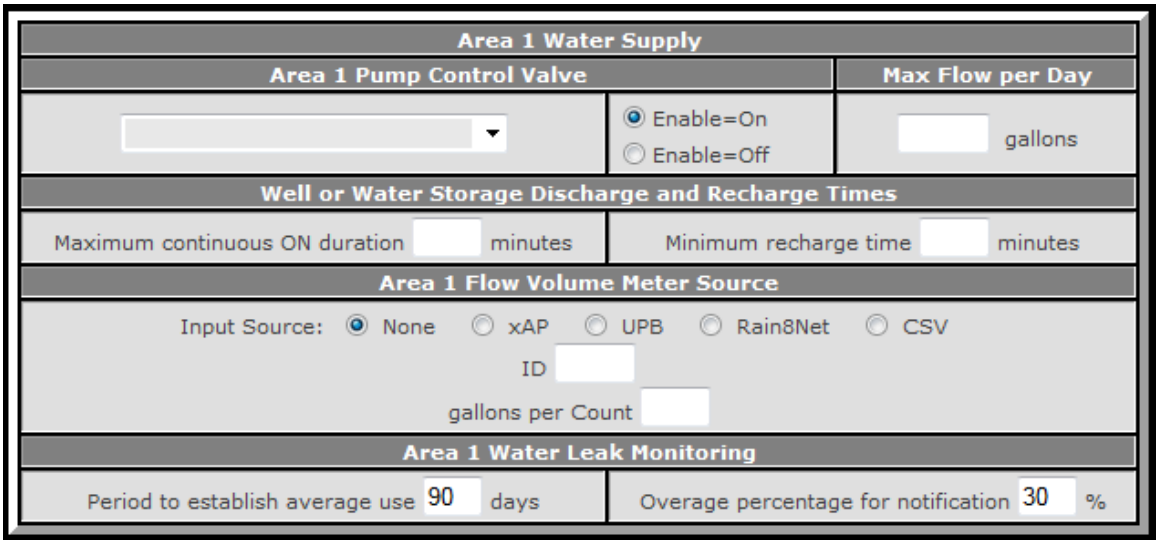

Area 1 Water Supply
Area 1 Pump Control Valve
Max Flow per Day
Enable=On
Enable=Off
gallons
Well or Water Storage Discharge and Recharge Times
Maximum continuous ON duration minutes
Minimum recharge time minutes
Area 1 Flow Volume Meter Source
Input Source: None xAP UPB Rain8Net CSV
ID
gallons per Count
Area 1 Water Leak Monitoring
Period to establish average use 90 days
Overage percentage for notification 30 %

Figure 38 Water Supply / Pump / Meter setup

Another optional capability is the control of a valve that is used to dispense liquid fertilizer. This feature is enabled when a valve is selected for the Fertigation control valve. When selected the Zone setup page will provide additional fields to specify the percentage of time the Fertigation valve should be ON when the zone is ON. This provides zone-by-zone control of Fertigation.

The other Fertigation settings on the Area setup page are used to alter the Fertigation percentages using adaptive control rather than fixed percentage control and to identify a meter source if the liquid fertilizer container volume can be measured. When the volume switch engaged then mcsSprinklers will provide a notification that a refill is needed. The Fertigation setup is shown in Figure 39.

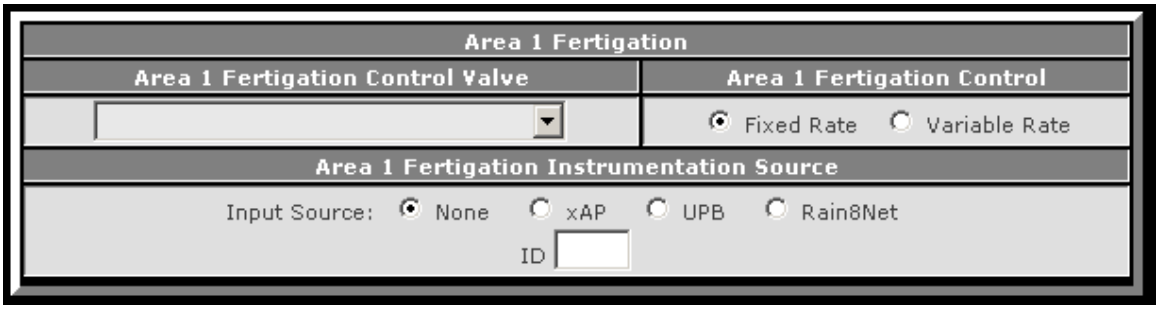


Figure 39 Fertigation Control and Instrumentation

The start times are also optional for the timed modes and not available for the measured and ET calculated modes. If an area is watered multiple times within the same day then the start times for each of these cycles must be entered. The times can be an absolute time using a 24-hour clock or values relative to sunrise or sunset.

Up to three Inhibit times applicable for only zone in the area can be entered. This provides the same functionality as the between hours inhibit on the Restriction Page described in paragraph 5.5, but is applied on an area-by-area basis. Time can be sunrise-relative. For example, a value of –2 will indicate two hours before sunrise.

Associated with each of the start times is a factor to apply to the duration for a zone. This allows different durations to be used throughout the day. If two start times are entered and duration factors of 1.0 and 0.2 for a zone with auto duration of 60 minutes, then the first cycle of the day will be for 60 minutes and the second will be for 60 * 0.2 = 12 minutes.

The Seasonal percentages also apply to a zone's duration. These are applied on a month-by-month basis. A month that has a 70% value for its seasonal percentage will reduce the zone's duration by 30%. If it was setup for 60 minutes and the month's seasonal percentage is 70% then the actual duration when a cycle is run will be 60 * .7 = 42 minutes. Note that the time slot factors also apply with the resultant time being the composite of the two.

When a control strategy based upon soil moisture is used then the scheduling automatically changes based up daily and seasonal variations. When a time-based strategy is used this automatic adjustment does not occur. mcsSprinklers provides a means to accomplish a similar effect on a monthly basis. In this case the watering times are scaled by a percentage factor so when watering does occur it will occur for a shorter period as the seasonal need for additional moisture is reduced. When a zip code is first selected the historical percentages for each month will be inserted as the starting point. These can be manually changed and will remain until the zip code is changed.

The setup segment is shown in Figure 40 and Figure 41. The seasonal variations can be manually entered per Figure 40 or the entire group for all areas can be done with the radio setting of Figure 41. A global selection for 100% removes the effect of seasonal variation. A global setting to Historical averages sets all values to their historical ETo's for each month.

The adjustment provided in Figure 41 in the range of -20 to +20 percent can be used to adjust the auto duration program of all zones without affecting the seasonal variation. It can be considered a tuning adjustment which is also available from the touch page interface via a slider.

The Site Name is used to associate a picture filename as well as label the status device that represents the composite of any zone being active. If the name is left blank the status device will be named “Sprinklers Active”. See Section 7.2 for more information on the management of popup pictures.

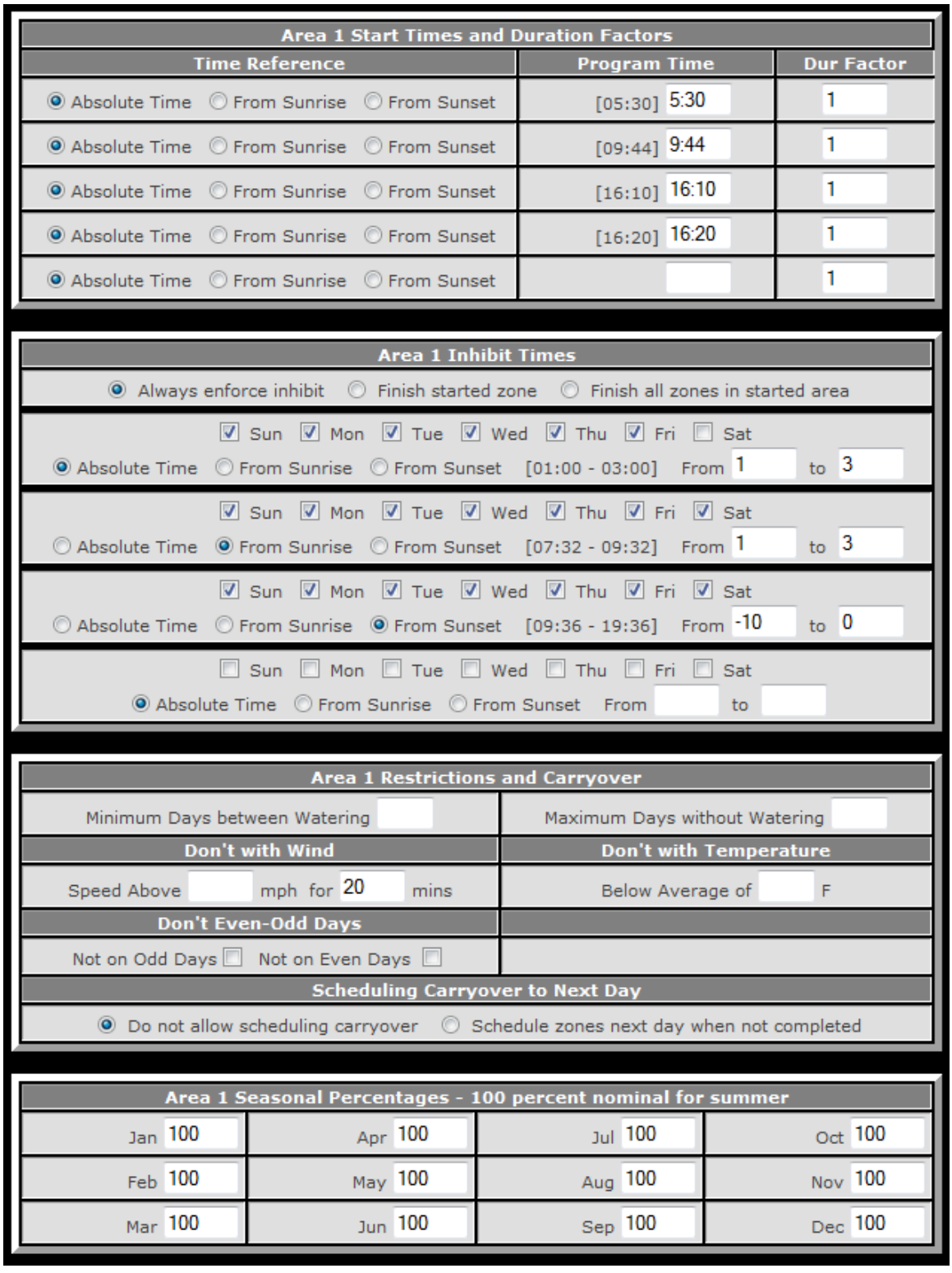

Area 1 Start Times and Duration Factors
Time Reference
Program Time
Dur Factor
Absolute Time From Sunrise From Sunset [05:30] 5:30 1
Absolute Time From Sunrise From Sunset [09:44] 9:44 1
Absolute Time From Sunrise From Sunset [16:10] 16:10 1
Absolute Time From Sunrise From Sunset [16:20] 16:20 1
Absolute Time From Sunrise From Sunset 1
Area 1 Inhibit Times
Always enforce inhibit Finish started zone Finish all zones in started area
Sun Mon Tue Wed Thu Fri Sat
Absolute Time From Sunrise From Sunset [01:00 - 03:00] From 1 to 3
Sun Mon Tue Wed Thu Fri Sat
Absolute Time From Sunrise From Sunset [07:32 - 09:32] From 1 to 3
Sun Mon Tue Wed Thu Fri Sat
Absolute Time From Sunrise From Sunset [09:36 - 19:36] From -10 to 0
Sun Mon Tue Wed Thu Fri Sat
Absolute Time From Sunrise From Sunset From to
Area 1 Restrictions and Carryover
Minimum Days between Watering
Maximum Days without Watering
Don't with Wind
Don't with Temperature
Speed Above mph for 20 mins
Below Average of F
Don't Even-Odd Days
Not on Odd Days Not on Even Days
Scheduling Carryover to Next Day
Do not allow scheduling carryover Schedule zones next day when not completed
Area 1 Seasonal Percentages - 100 percent nominal for summer
Jan 100 Apr 100 Jul 100 Oct 100
Feb 100 May 100 Aug 100 Nov 100
Mar 100 Jun 100 Sep 100 Dec 100

Figure 40 Adjustments in Timed Control and Seasonal Variation

The Site page provides a global inhibit to prevent irrigation during certain times of the day. Time of day inhibits can also be entered for specific areas. This becomes useful when using a measured or calculated strategy for some, but not all areas. By using the time of day inhibits shown in Figure 40 the start time can be controlled.

These inhibit time boxes allow use of the "+" and "-"to indicate a time that is relative to sunrise. Numbers without this prefix are absolute times using a 24 hour clock. A time of 2:30 PM would be entered as 14:30. When a zone is otherwise available for irrigation, but inhibited due to the Area Time of Day inhibit, then the General Status Between Hours inhibit will be shown.

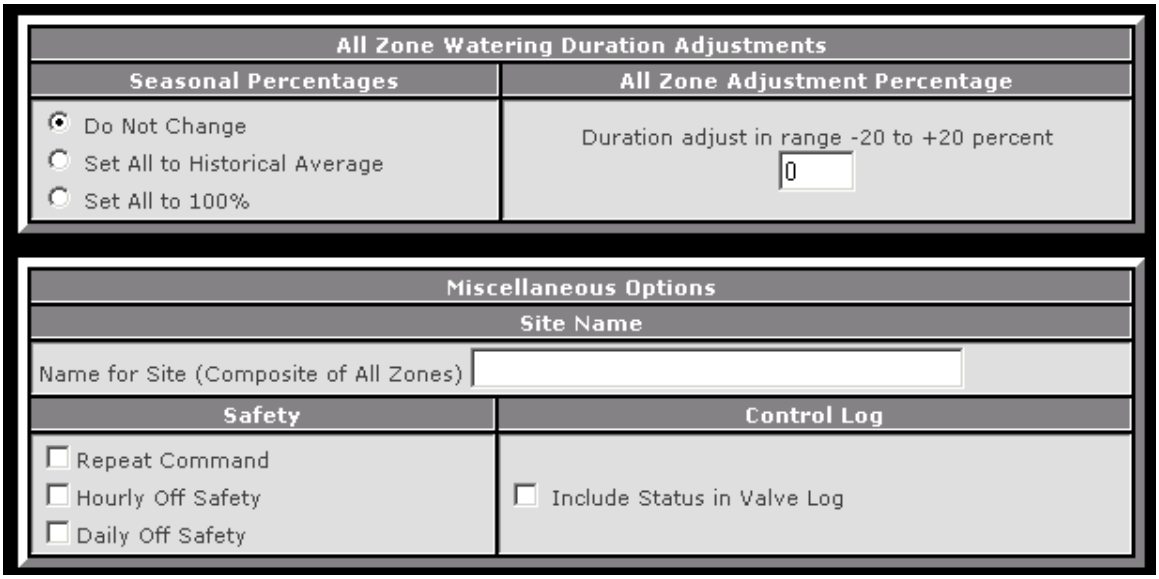


Figure 41 Miscellaneous Scheduling Option Setup

Global site restrictions defined on the Site page provide scheduling inhibits that apply to the entire site. Each area also has a set of area-specific inhibits that control only the scheduling of zones within the area. This setup is shown in Figure 42. Use of area-specific inhibits may be appropriate, as an example, when drip zones are used that are not affected by wind, but lawn zones are.

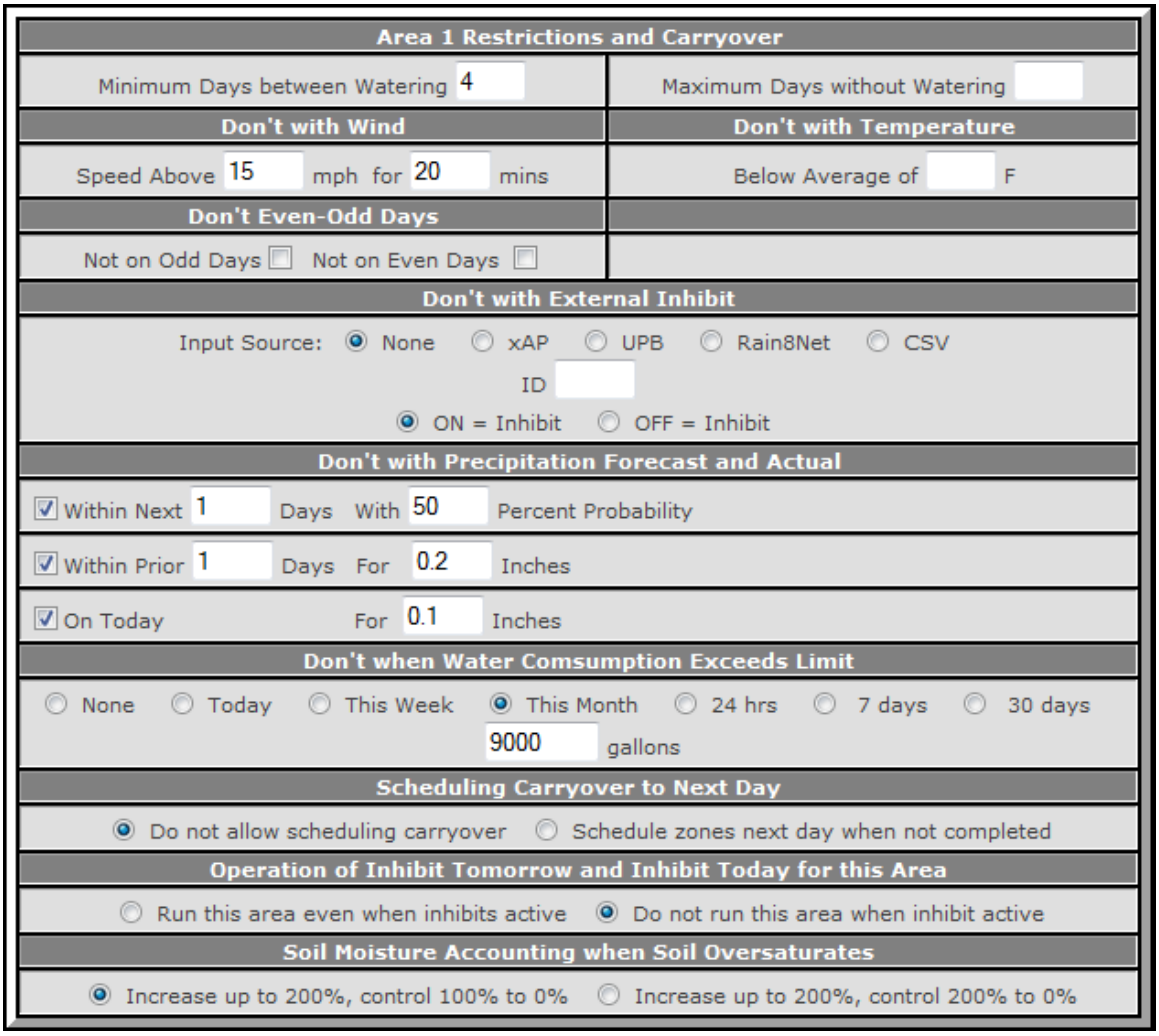

Area 1 Restrictions and Carryover
Minimum Days between Watering 4
Maximum Days without Watering
Don't with Wind
Don't with Temperature
Speed Above 15 mph for 20 mins
Below Average of F
Don't Even-Odd Days
Not on Odd Days
Not on Even Days
Don't with External Inhibit
Input Source: None xAP UPB Rain8Net CSV
ID
ON = Inhibit OFF = Inhibit
Don't with Precipitation Forecast and Actual
Within Next 1 Days With 50 Percent Probability
Within Prior 1 Days For 0.2 Inches
On Today For 0.1 Inches
Don't when Water Comsumption Exceeds Limit
None Today This Week This Month 24 hrs 7 days 30 days
9000 gallons
Scheduling Carryover to Next Day
Do not allow scheduling carryover Schedule zones next day when not completed
Operation of Inhibit Tomorrow and Inhibit Today for this Area
Run this area even when inhibits active Do not run this area when inhibit active
Soil Moisture Accounting when Soil Oversaturates
Increase up to 200%, control 100% to 0% Increase up to 200%, control 200% to 0%

Figure 42 Area-Specific Restrictions and Carryover

5.2.2 Suggestions for Calibration of Calculated Evaporation

There are many factors that affect the soil moisture content. mcsSprinklers attempts to simplify the setup for this calculation; however it is still not a simple matter.

There are two primary considerations. One is how long should a zone be watered and the second is how often should it be watered. The duration is based upon the volume of water that can be applied over a fixed area of crop. This is dictated by the water flow rates and the efficiency of the irrigation heads at evenly dispersing the water. mcsSprinklers does not attempt to calculate the duration, but will adjust the duration on a month to month basis to account for seasonal factors related to soil moisture content. A nominal duration of 30 to 60 minutes is a reasonable starting point. Observe the moisture content in the soil immediately after a cycle and make adjustments up or down to achieve the desired result.

If allowed to run in auto mode, mcsSprinklers will always engage a zone for the duration specified. When the cycle is complete it assumes that the moisture content is at 100%. This is true if the moisture content was 0 or 50% when the cycle started.

The adjustments to be made with the software settings related to how long does it take for the moisture to be released from the soil. There are two factors that can be controlled on a zone by zone basis, one factor on an area by area basis, and one factor that can be applied to the entire system. The zone-based factors are soil and rain efficiency. The area factor is the minimum threshold. The system-wide factor is solar intensity.

A typical summer day will lose moisture from the soil due to Evapotranspiration at a nominal rate of about 0.25 inch per day. This, of course, varies by location. Monthly averages for summer range between 5 and 10 inches within the United States. The primary contributor to moisture loss is solar radiation and there is usually no readily available sensor or source for this information. mcsSprinklers uses the internet-published UV index to make an estimate in most case. It will also use the in-the-shade vs. in-the-sun temperature sensors to estimate it if those sensors sources are available and selected. There is a degree of uncertainty and variance between locations that some calibration of the solar effects is needed. This is most easily done with a container of water left exposed to the environment for a 24 hour period. The measured evaporation vs. the calculated daily ET for the same period will provide an insight if any changes to the nominal 1.0 solar factor are needed. An increase to 1.1 will yield roughly a 10% increase in moisture loss over a 24 hour period.

If your intention is to irrigate when 0.4 inch of moisture is lost then you will set the Area's min threshold to 60%. This means mcsSprinklers will try to keep the moisture content in the range between 60% and 100%. It depends upon you to set the duration of a watering cycle and select a distribution system that will provide an average of 0.4 inches of water over all zones in the area. You can calculate the time needed based upon the gallon per minute rating of your system or you can measure the effective moisture after a cycle has completed.

With the solar factor and the min threshold applied a reasonable nominal schedule should not be available. It is often the case that exposure to sunlight, soil quality, or type of crop will vary between zones in an area. This is where the soil factor can be applied. If the crop retains water better than grass then it should be adjusted downward. If the soil is sandy then the efficiency factor should be adjusted upward

When the software is initially used it may be useful to run it in a timed mode (Day-of-week, Even-Odd, or Interval) using your best judgment as to the frequency of irrigation that is appropriate. The Area Setup page will show a graphic of the calculated moisture content over the past seven days. During this experimental period the objective is see a saw tooth pattern where the flat spots at the top and bottom are minimized.. For example, assume a two-day interval is being used. This means that the moisture level should go from saturated (100%) to dry (0%) over a two day period. If this is happening then no adjustments are needed.

If it only goes down from 100% to 50% over two days then the moisture loss calculation needs to be tuned to yield a faster moisture loss rate. The moisture loss is computed each hour based upon the average ET calculation over the past hour. This calculation is driven primarily by solar radiation and this measurement is not directly available from the internet in real time so estimates need to be made. The estimates can be adjusted with the Soil Efficiency factor on the Zone Setup. Since the factor is associated with only one zone then different values can be used to account for shade and soil type.

5.3 Zone Sequencing

Area irrigation is enabled by the control strategy and the restrictions applied to an area. Once an area has been enabled then the zones will cycle based upon the order that the zone was setup in the Zone Setup page. If the Area sequence control is set for use of a single master sequence then the sequence order will be by Area. If the Area sequence control is set for Area Sequence then multiple areas can be active at the same time with the zone order within an area being the order setup on the Zone Setup page.
A normal sequence will irrigate a zone for the duration setup for the auto program for that zone. This value is a combination of three setup entries. The first is the Auto minutes on the Zone Setup page. The second is the Duration Factor associated with an Area Setup page Start Time. These start times are only available in the three timed control strategy and not available in the ET calculated or measured strategies. The third

is also on the Area Setup page and is the Seasonal Percentages that are entered on a month by month basis. For example, Auto Time = 50, Dur Factor = .8, Seasonal Percentage = 90 will result in a zone run time of (50 * 0.8 * 90/100) = 36 minutes.

A zone is normally run for the full duration before the next zone is started. To reduce runoff from too much water at one time, a round-robin sequence can be setup on the Area Setup page to split the area's irrigation into shorter time bursts. This is setup using the InterZone Scheduling delays. If, for example, an Area has three zones with 6 minutes run time per zone with a round-robin setup for 6 cycles. This means that the total of 18 minutes in the area will be run with 6 cycles of 1 minute each in the order Zone 1, Zone 2, Zone 3, Zone 1, Zone 2, etc. Progress in the round-robin cycle can be observed on the Zone Status page such as shown in Figure 43. In this figure it shows that B1 Status is "Round Robin" and it has 4 minutes left to complete. This means the zone is not currently active, but it will be cycling with other zones in the same area in a round robin fashion. B2 is the zone that is currently running in the area. Zone B3 is also round robin and is have 5 minutes remaining to complete.

The scheduling model used by mcsSprinklers starts at midnight and goes for 24 hours. At midnight of the next day a control cycle will start for the times and conditions setup for that new day. A carryover provision exists, if selected on the Area Setup Page as shown in Figure 42, will allow zones that did not complete the day's scheduled irrigation to continue to run past midnight until completion. This carryover is intended to deal with situations where a scheduled irrigation did not complete due to some temporary inhibit conditions that delayed the schedule. It is not intended to allow full irrigation schedules to shift into the next day. This means that a normal irrigation cycle will start sometime after midnight, but generally not just before midnight.

Lawn and Garden Calculated ET (50%)	Run Area 1 Now		
B1: Front Lawn		**Status: Round Robin**	
☐ Disable Automatic Control	Round Robin with 4 mins left		
☐ Enable Manual for 1 mins	Last on Today 9:39 AM		
☐ 50% ☐ 100% % Set Soil Moisture	Cycles: 2	Wk Mins: 214	Soil: 67%
B2: Back Lawn		**Status: Watering Now**	
☐ Disable Automatic Control	Started at 9:39 AM with 5 mins left		
☐ Enable Manual for 2 mins	Last on Today 9:39 AM		
☐ 50% ☐ 100% % Set Soil Moisture	Cycles: 1	Wk Mins: 157	Soil: 58%
B3: Garden		**Status: Round Robin**	
☐ Disable Automatic Control	Round Robin with 5 mins left		
☐ Enable Manual for 2 mins	Last on Today 9:38 AM		
☐ 50% ☐ 100% % Set Soil Moisture	Cycles: 1	Wk Mins: 118	Soil: 58%

Figure 43 Round Robin Scheduling Status

Additional timing variation can be achieved with the round-robin by adding a delay between each zone's control. A delay can be added between each zone, independent of round-robin scheduling as well.

Zones are scheduled for irrigation per the Control Strategy, but this schedule is affected by inhibit conditions. It is possible that one or more inhibits are active throughout the entire scheduled period for a zone. When a zone has multiple start times (i.e. multiple programs) and a program is not run due to inhibits then this program will be skipped. When all programs within a day have been skipped due to inhibits then

a carryover into the next day can be setup to allow the zone to be run at the first available time in the next day. This setting is part of the Restrictions and Carryover on the Area Page as shown in Figure 42.

Situations can occur when rainfall causes a zone to calculate moisture levels greater than 100%. For periods of continuous rain a zone may record up to 200% soil moisture level. When the rain stops and evapotranspiration starts the moisture accounting will either go immediately to 100% or it will gradually decrease based upon the calculated moisture loss. If the soil conditions are such that 100% is truly saturation then the option to snap to 100% is the appropriate setting. If the soil conditions will actually hold more than the assumed 100% then a gradual decrease is the appropriate setting.

5.4 Syringing

Syringing is the light sprinkling of water on turf usually done during the hottest part of the day to prevent wilting. During the course of the day, the sun evaporates tremendous amounts of water from the soil and plant tissue. Evaporation through plant tissue is called Evapotranspiration. During the hottest days of the year the Evapotranspiration rate often exceeds the plants ability to draw water in from the soil. The result of this water deficit is wilt. Often times during clear sunny days you can see the turf turning shades of blue and gray. These are signs that the turf grass plants are in need of water and if water is not applied at that time the grass will die. This is most important as Annual Bluegrass is a very shallow rooted winter annual and if it dies it will not recover until new seeds germinate in the fall. To reduce the stress from this water deficit syringing is implemented. Syringing is not actually replacing the water in the soil but instead it reduces the wilting cycle by cooling off the turf and temporarily stopping wilt until rainfall or hand watering can be initiated.

Control for syringing is done from a combination of the Zone Setup page shown in Figure 20 and Other Setup page shown in Figure 44. Syringing can be selected on a zone by zone basis on the Zone Setup page where the number of minutes to run during the syringing cycle is specified. The actually running of the once-per-day cycle is controlled by time, temperature threshold, or ET threshold.

The syringing cycle will obey all Restriction and Area Page restrictions except the Between Hours restriction and Start Time designators. When run it will act as a manual control cycle, hence have precedence over the auto control cycle. Other zones that may be in an auto cycle at the syringing time will be delayed until all syringing is completed.

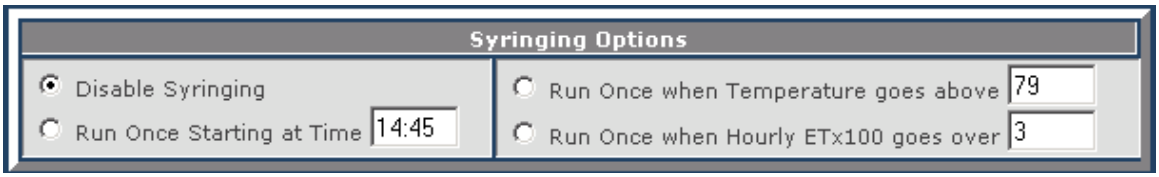


Figure 44 Syringing Control Options

5.5 Watering Restrictions

It may be possible to run the sprinklers on a schedule that is close to optimal for the interest of the foliage, but this is not the only realistic consideration. It really does not make sense to water in the middle of a downpour, nor does it make sense to water in the evening when there may be recreational use of the area. It may also be the case that local regulations limit when water can be used for irrigation.

These perturbations to an ideal cycle are easily expressed in terms of when not to water. Selection of specific days of the week in which not to water provides a lifestyle input. Input for the time-of-day when watering should not happen provide a second form of the lifestyle preferences.

The time-of-day also has scientific significance. Water should be applied at a time-of-day when it has an opportunity to soak into the soil. When applied in the middle of a sunny day most of it will be burned-off

rather than soaked-in. In many climates surface water will encourages undesirable fungus growth. The length of time that surface water is present should be minimized to combat fungus. This means that the best time to apply water is at sunrise so it will have time to soak and remaining water quickly burned-off. There are two ways to control when watering will occur. . The first is with start time preferences as shown in Figure 38. The second is to limit when watering cannot occur per the setup shown in the Between Hours selections of Figure 45.

It is also desirable to restrict the normal watering cycle to conserve either water or money. Any wind over a light breeze will affect the location where the sprinkler water falls. Wind cannot be controlled, but when it is windy it is smart to not run the sprinklers.

For similar reasons it is also does not make sense to run the sprinklers when it is raining. Not only is it a conservation/cost issue, but it also reflects on being a good neighbor and not doing something that appears dumb. Going beyond this it also makes sense to take advantage of Mother Nature. If she is going to be providing the necessary rainfall in the near future then just wait for her and save your water for a non-rainy day.

Rain restrictions take three forms: Prior actual rain, actual rain today, or forecasted rain. Selecting the corresponding checkbox can employ any of the three. A minimum rainfall level that must be achieved can further qualify them. These are in units of the rain sensor (in or mm) and are entered into the text boxes. Actual rain is determined from the rain sensor. Forecasted rain is determined from the icon for each of the future day's forecast. Most forecast sites do a new day rollover sometime around sunset. This means that the forecast can change in the evening and a restriction may active or be removed as the accounting is rolled. To deal with this is may also be advantageous to set a time restriction for the evening hours.

Most jurisdictions water conservation rules can be accommodated with a setting that will not allow an even-day or odd-day watering. In other cases the ban-period period may be extended to two or more days.

To prevent excessive cycles the Max Cycles In Day option can be used to put an upper limit. This would normally come into play if the calculation for evaporation or the measurement sensor produces excessive control demands. (i.e. the sensor is stuck)

If some type of rain moisture pad, security interlock or other form of discrete input is available then it can be used to inhibit irrigation. The source of this discrete needs to be identified as well as the polarity to use to indicate an inhibit condition.

If irrigation water consumption is being measured or being estimated based upon flow rates then this parameter can also be used as a means to restrict irrigation. There may be water cost rate schedules that may make use of water beyond some threshold prohibitively expensive. A limit can be selected to be within the current day, week or month period or it can be set to be a fixed interval or one, seven or thirty days. For example, if a consumption limit is set to 1000 gallons for the month and on the 20th of the month this level has been utilized then no more auto-schedule irrigation will be allowed for the remainder of the month.

The interval selected for water consumption restriction is the same interval that is used for the Site status device where the water consumption is displayed. If no interval is selected then the default display will be for water use within the last 30 days. If no restriction is needed, yet different intervals desired on the display then setup a restriction with a level that will not be achieved.

It is possible that a normal day's irrigation cycle will not complete before midnight due to exercise of restrictions that limit the amount of time that is available to run during a day. If a timed control strategy is used for a zone that does not complete then a notification message will be delivered at midnight to indicate that the zone did not complete during the day and it will be run the following day at the first available time. When this situation occurs for the other control strategies no message will be delivered since the scheduling is not based upon a specific day's control.

All of these restrictions and preferences can be specified in mcsSprinklers. Most of them are collocated on the Setup6-Site setup page. It is shown in Figure 45. Note that Area-specific restrictions can also be defined per Figure 42.

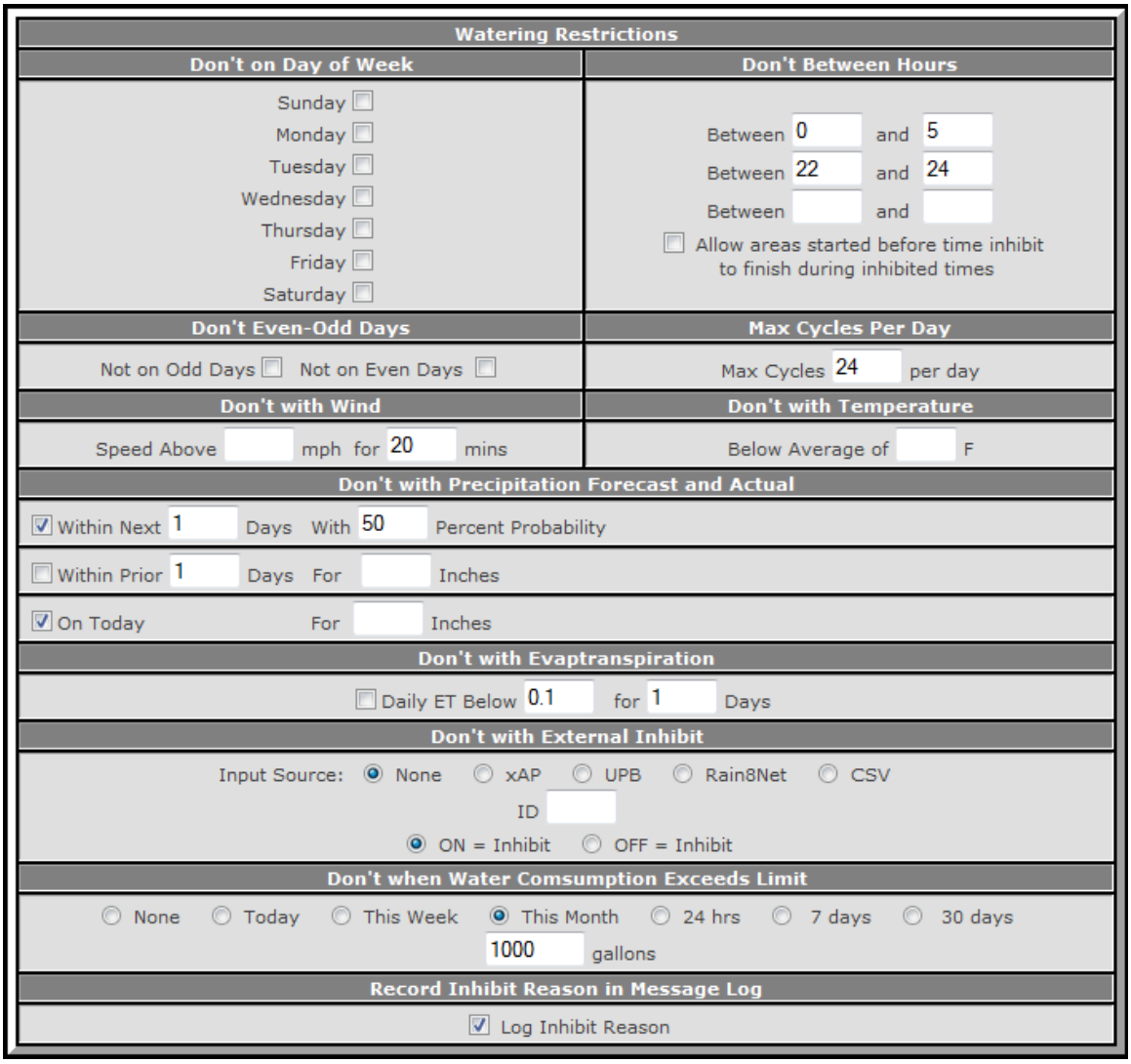

Watering Restrictions
Don't on Day of Week
Sunday
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Don't Between Hours
Between 0 and 5
Between 22 and 24
Between and
Allow areas started before time inhibit to finish during inhibited times
Don't Even-Odd Days
Not on Odd Days
Not on Even Days
Max Cycles Per Day
Max Cycles 24 per day
Don't with Wind
Speed Above mph for 20 mins
Don't with Temperature
Below Average of F
Don't with Precipitation Forecast and Actual
Within Next 1 Days With 50 Percent Probability
Within Prior 1 Days For Inches
On Today For Inches
Don't with Evaptranspiration
Daily ET Below 0.1 for 1 Days
Don't with External Inhibit
Input Source: None xAP UPB Rain8Net CSV
ID
ON = Inhibit
OFF = Inhibit
Don't when Water Comsumption Exceeds Limit
None Today This Week This Month 24 hrs 7 days 30 days
1000 gallons
Record Inhibit Reason in Message Log
Log Inhibit Reason

Figure 45 Site Watering Restrictions Setup

5.6 Water Use Management

5.6.1 Water User Monitoring

Water use monitoring can be setup and when the daily use is beyond the threshold a notification will be delivered. This notification will be in the message log and email if setup. Three levels of monitoring can be setup. These are at the zone, at the area, and at the site.

The Zone Setup page provides provisions for entry of a maximum expected water use for each zone. If a value is entered and the measured water use for that zone exceeds the maximum then a notification will be

provided. This form of notification will not provide water-leakage type information since measurement at the zone level is only made when the zone is ON. This capability depends upon an external water meter to measure water flow for the area.

The Area Setup page provides an entry for a maximum flow for the area. The flow maximum is associated with the water meter for the area and it is monitored at all times. The notification in this case will detect line breakages assuming that the meter is only monitoring irrigation water.

5.6.2 Water Use Measurement and Display

The volume of water being utilized for irrigation can be measured and/or calculated by mcsSprinklers. Measurements are provided by external water meter sensor(s). Calculations are based upon flow rate information for a zone.

If calculations of water use are to be maintained by mcsSprinklers then the flow rates for each zone need to be entered on the Zone Setup page as shown in Figure 20. mcsSprinklers will accumulate the water use based upon the run times for each zone. This water use can be viewed as a running total as a status device on the General Status page. Day-by-Day and hour-by-hour visibility of the water use can be viewed from the calendar popup when the water flow status device calendar icon is clicked.

If water flow meters are available then they can be used to measure the water use during the time a zone is active. In this case the Calc entry on the Zone Setup page should be left blank. The average of the use over the last 30 days will be shown for reference and this value will be used to project future water use while a zone is running. A Max flow per day value can be entered. When this value is exceeded a message will be recorded and email notification performed if email is setup.

Provisions exist for one water meter per area. If only one water meter exists then the same meter source location should be used for each area.

When a zone is turned ON mcsSprinklers will take a snapshot of the water meter reading and then accumulate the water meter readings as long as the zone remains ON. If multiple zones are ON at the same time then mcsSprinklers will assume each zone has an equal consumption.

The water use can be viewed on the General Status page in the Area and Site status devices as a rolling total over the past 30 days. The raw water meter readings are also shown for each meter when a meter is present. An example can be seen in Figure 46. In this example one meter was present at the site. The current meter reading was 1125 gallons. The site had consumed 1416 gallons over the past 30 days. Of these 170 gallons were in Area 1, 180 in Area 4, and the remainder in Area 5.

When the calendar icon is clicked for an area or site then the daily water use values will be displayed as shown in Figure 63. Further detail on an hourly basis is seen by clicking on the calendar day. If visibility for a specific zone is desired then the calendar can be access from the General Status page zone status calendar icon as shown in Figure 50.

170 gal/month	S45	Area 1 Status	Today 10:05:16 AM	OFF ON
0 gal/month	S46	Area 2 Status	Today 10:05:16 AM	OFF ON
0 gal/month	S47	Area 3 Status	Today 10:05:16 AM	OFF ON
180 gal/month	S48	Area 4 Status	Today 10:05:16 AM	OFF ON
1066 gal/month	S49	Area 5 Status	Today 10:05:16 AM	OFF ON
1416 gal/month	S53	Site Status	Today 10:05:16 AM	OFF ON
1125 gal	S54	Water Meter 1	7/21/2006 11:43:47 PM	
1125 gal	S55	Water Meter 2	7/21/2006 11:43:47 PM	
1125 gal	S56	Water Meter 3	7/21/2006 11:43:47 PM	
1125 gal	S57	Water Meter 4	7/21/2006 11:43:47 PM	
1125 gal	S58	Water Meter 5	7/21/2006 11:43:47 PM	

Figure 46 Measured Water Consumption

If there is a storage or pressure tank that is being used at t he site and mcsSprinklers should assure that the tank has sufficient water prior to running a zone then the Water Tank parameters should be setup on the Site Setup Page. The model for management of the tank is to establish a full volume, the minimum volume at which irrigation should be allowed and the rate at which the tank is being filled from its water source. mcsSprinklers will account for water that is being used based upon measurements or flow rates setup and will account for the refill rates. When the tank level goes below the minimum threshold then irrigation is inhibited. It will remain inhibited until the tank is refilled to the 50% level between the minimum and full settings. The current level of the tank can be observed from the Water Tank status device on the General Status Page.

5.7 Fertigation

Fertigation is the application of liquid fertilizer through the irrigation system. mcsSprinklers controls fertigation based upon setup information contained on the Zone Setup and Area Setup pages. The Zone Setup provides the nominal factor that determines how long a fertigation valve will remain ON with respect the full run time of the zone. If the Zone Setup page has Fertigation factors of 0.5 and 1.0 then the first zone will enable the fertigation valve for 50% of the run time for the zone and the second zone will enable the fertigation valve for 100% of the zone's run time.

The identification of the valve to be used for fertigation is identified on the Area Setup page as shown below. The pink arrow shows the segment of the Area Setup that applies to fertigation.

The fertigation can be controlled based upon a fixed percentage of the zone run time or it can be controlled based upon a variable percentage. The variable control will increase the percentage when the time between irrigation cycles increases and will decrease it when the time becomes short.

A fertigation instrumentation source is provided. This is intended to provide a measurement that will allow mcsSprinklers to provide a notification via message and email when the fertigation media has reached a low level.

mcsSprinklers maintains a database that will show minutes of fertigation for each zone as well as for the total minutes the fertigation valve is ON. Status information is available from the page as shown in Figure 47 and from calendar popup such as are shown in Figure 48 and Figure 49. The general status shows a level indicator icon for the fertigation supply/valve and provides the number of minutes that the fertigation valve has been ON over the past 30 days. When the value is ON then the icon is animated to show consumption.

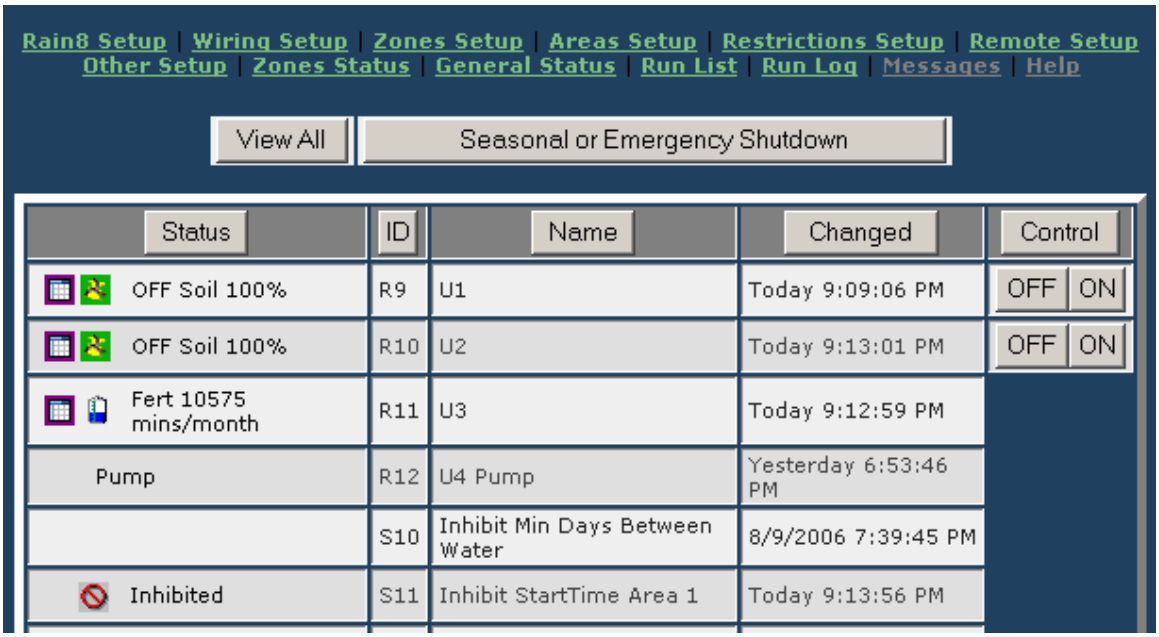


Figure 47 Fertigation Valve on General Status Page

To the left of the level indicator and the zone valve icons are calendar icons. When clicked then a calendar popup is shown. The calendar provides a nominal 90 day view of past and projected behaviors.

One calendar view is displayed when the calendar for the zone valve icon is clicked. When any day's cell is clicked on the calendar then a detail popup will show the daily detail for the selected day. A second calendar view is shown when the calendar icon next to the fertigation valve is clicked. In this case the calendar shows the icon associated with the fertigation valve for any day that the fertigation valve was ON. There is also a level-indicator icon where the level is angled. This is the projected day when the next fertigation will occur.

When any day's cell is clicked then the detail for the day pops up.

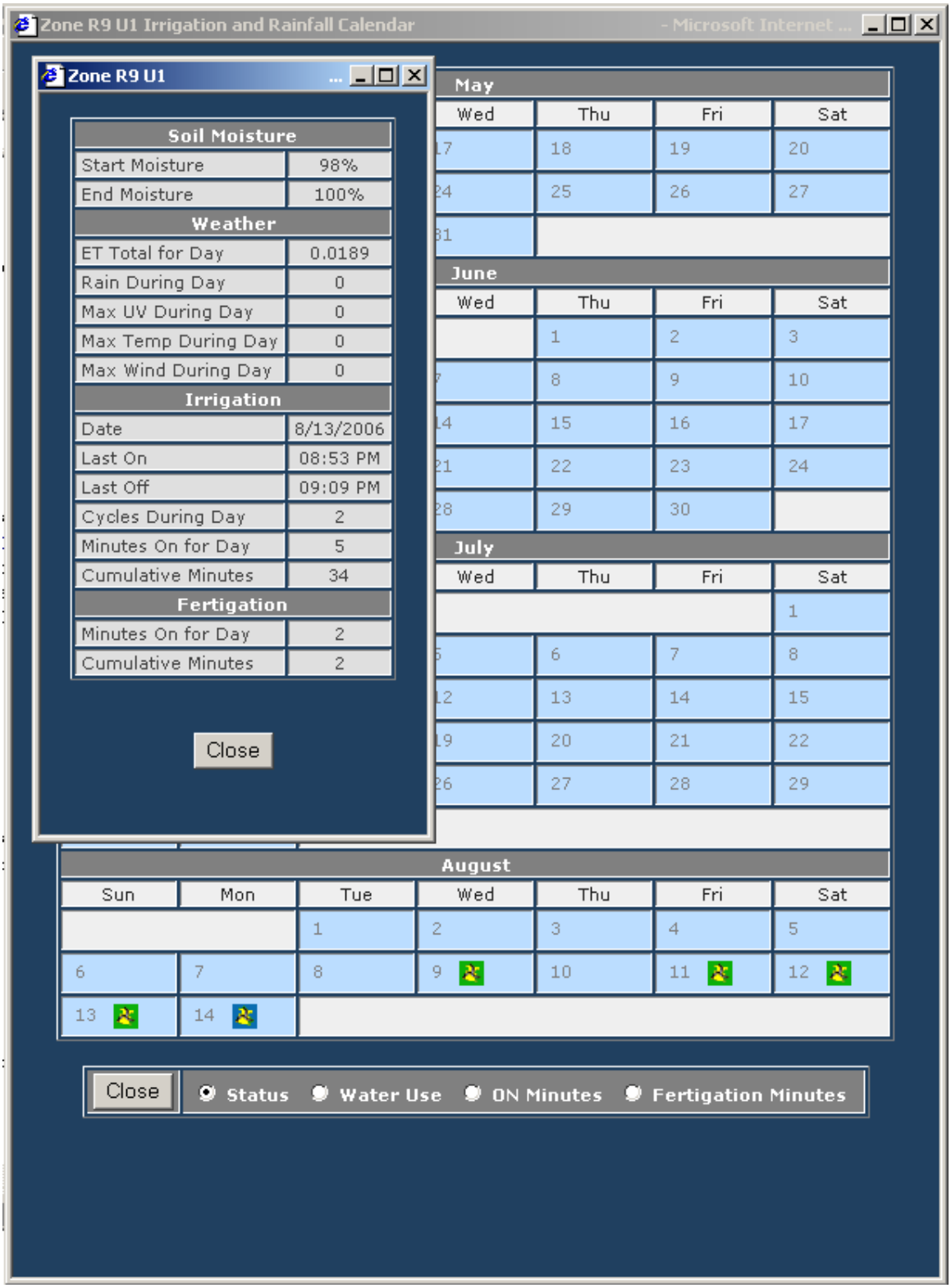


Figure 48 Fertigation Data on Calendar Detail for Zone Valve

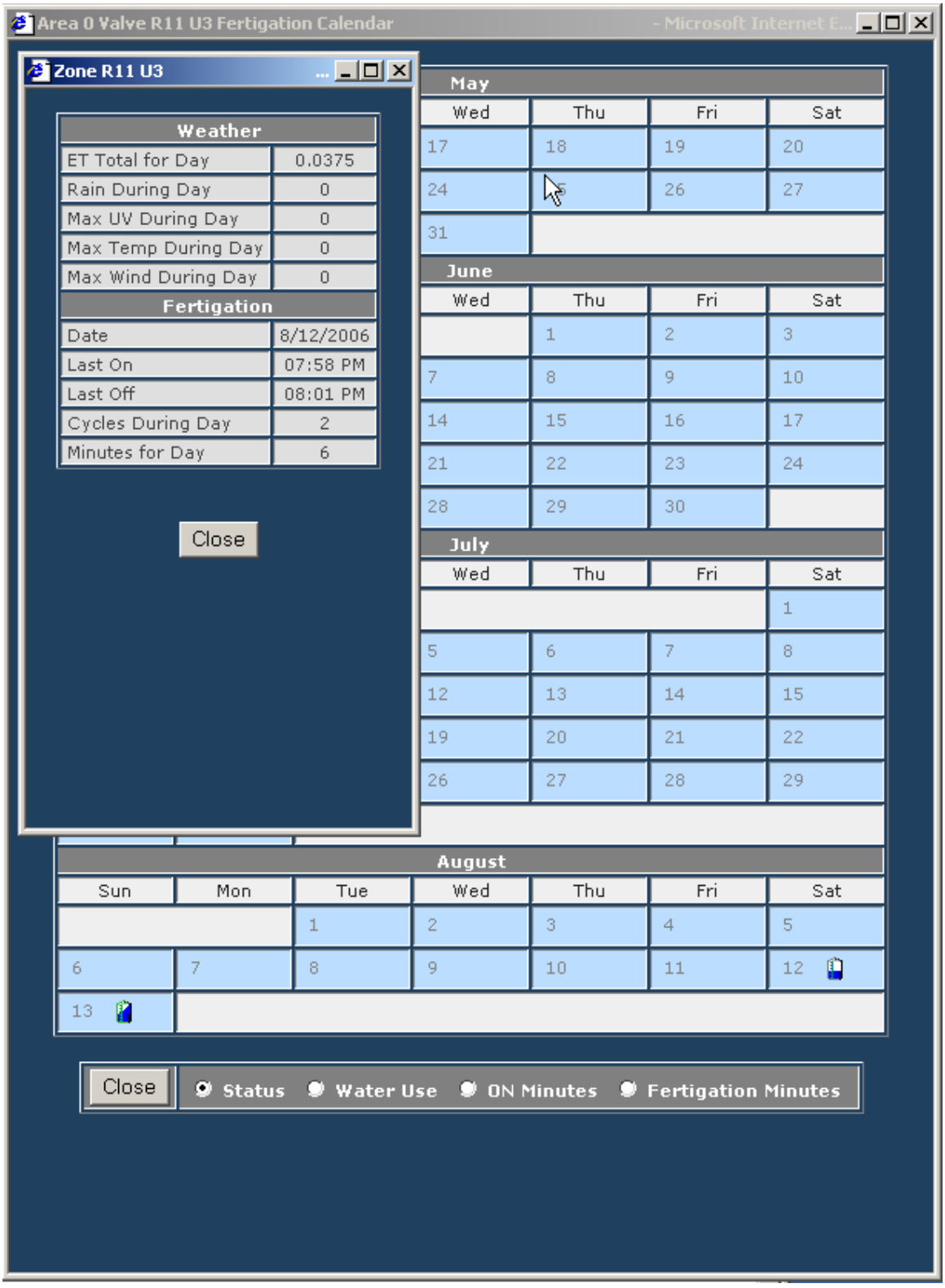


Figure 49 Fertigation Calendar Detail for Fertigation Valve

6 Manual Control Options

While the focus of mcsSprinklers is to provide a fully automated irrigation solution, it also integrates the automatic modes with a manual control capability. The manual control will override the automatic control when this mode of operation is enabled. This means that the "Don't Water" and "Start Time" restrictions imposed on the automatic control are not obeyed for manual control.

Seasonal/Emergency actions take priority over individual zone Manual Control actions. When mcsSprinklers has been put into Seasonal Shutdown it will continue to perform all data collection operations, but there will be no valve activation performed by either automatic or manual actions.

A zone will remain under manual control until the zone has been watered once. Manual control for that zone will be deactivated. Automatic control will resume if it has not been disabled by the checkbox on the web page or toggled via the Alias Device.

The following elements of mcsSprinklers are involved with manual mode operations:

1. Browser Control
2. Handheld Remote Control
3. Power line Remote Control
4. Voice Control

6.1 Web Browser

Two browser views can be used to control manual operations. The General Status page will provide a clickable button for each valve and pump as well as master controls for Seasonal and Manual modes. Figure 50 shows these controls for two zones.

Figure 50 Manual Controls from General Status Page

The Seasonal or Emergency Shutdown button is used to totally disable all control functionality of mcsSprinklers. When it is clicked its label and function will change to restore normal control operations. This is the only place where this master control can be energized.

The ON and OFF buttons in the right-most column are used to individually turn a zone ON or OFF at the soonest possible time. This time will normally be immediately, but could be at some later time if other zones are scheduled for watering before this zone. When the zone does start then it will continue for the number of minutes previously entered for the manual duration. This setup is on the Setup4-Zones page as shown in Figure 18.

When a zone is manually turned ON then the manual mode master button at the top of the page will be relabeled to an Exit button. When the Exit button is clicked then all zones that have been manually started will be stopped immediately. Individual zones can be manually stopped with the OFF button associated with the zone.

The second browser page that provides manual control ability is the Zone Status page with an example shown in Figure 52. There are several elements integrated into this view. Those that relate to manual control operations are the four center buttons on the top row and the checkbox and textbox in the left column associated with manual control of a specific zone.

The Stop button has the same function as the Exit button on the General Status page. It will stop the watering off all zones for the remainder of the day. This Stop button will change to a Restart button when a manual stop has been performed.

The “Inhibit Tomorrow” button has a similar function to the “Inhibit Today” button, but it applies to all zones that would otherwise be activated tomorrow so that they will not be activated tomorrow. The Inhibit Tomorrow button affects only auto mode operations. When tomorrow arrives the manual mode operations can be used to override the inhibit introduced by Inhibit Tomorrow. The override can also be done with the “Inhibit Today” button which will have changed to “Allow Today” if the day became inhibited due to the “Inhibit Tomorrow” selection the prior day.

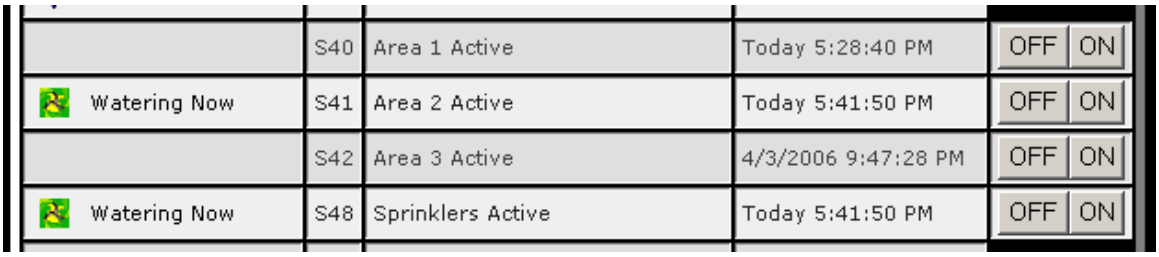
Both the “Inhibit Tomorrow” and “Inhibit Today” buttons can be configured to only function on selected Areas as illustrated in Figure 42. When the inhibit function has been disabled on the Area page then the zones of that area will continue to irrigate based upon the Area’s control strategy even when either “Inhibit Tomorrow” and “Inhibit Today” are activated. This could be useful if certain Areas will always be run when others are subject to the manual inhibit control buttons.

There is a status device on the General Status page that reflects the currently active inhibit condition based upon yesterday’s use of “Inhibit Tomorrow” or today’s use of “Inhibit Today”. If you change your mind when tomorrow arrives then the OFF control on the General Status page for the Inhibit Tomorrow Carry forward status can be used to re-enable auto mode control. The ON control of this device can also be used to inhibit the current days auto cycle.

When a zone has completed a watering cycle today then the Zone Status page will present a third Auto Mode control button “Rest Watered Today”. Use of this button will reset all zones so that it appears as if not watering cycles have occurred today. For the three timed control strategies there will also be a checkbox for each zone “Reset to Allow Cycle Today” that will allow selective zones to be reset rather than all zones. The selective update is actioned with the “Update” button after the checkbox(es) has been checked.

A full manual cycle can be started with the “Stat All Manual” button. Individual areas can be manually started with the “Run Area …Now” button. Individual zones can be manually started by checking the “Enable Manual Control” checkbox on the zone and when all desired zones have been checkboxed then the “Start Manual” button clicked.. Unlike on the General Status page, the number of minutes for manual control can be entered at the same time the manual control action is taken.

Controls are also provided on the General Status page to give access to manual control. This includes the individual zones as well as the area and complete set of zones. Figure 51 shows the OFF and ON controls provided on the General Status page for the composite areas and total of all zones. Manual control can also be performed from the Zone Status page as shown in Figure 52. In this case the desired manual control zones are selected with checkbox, the durations can be edited, and then started with Start Selected Manual button at the top of the page. All zones can also be run in manual mode with the Start All Manual or Manual Run Site Now buttons.



	S40	Area 1 Active	Today 5:28:40 PM	OFF ON
Watering Now	S41	Area 2 Active	Today 5:41:50 PM	OFF ON
	S42	Area 3 Active	4/3/2006 9:47:28 PM	OFF ON
Watering Now	S48	Sprinklers Active	Today 5:41:50 PM	OFF ON

Figure 51 Composite Controls Available on General Status for Manual Control

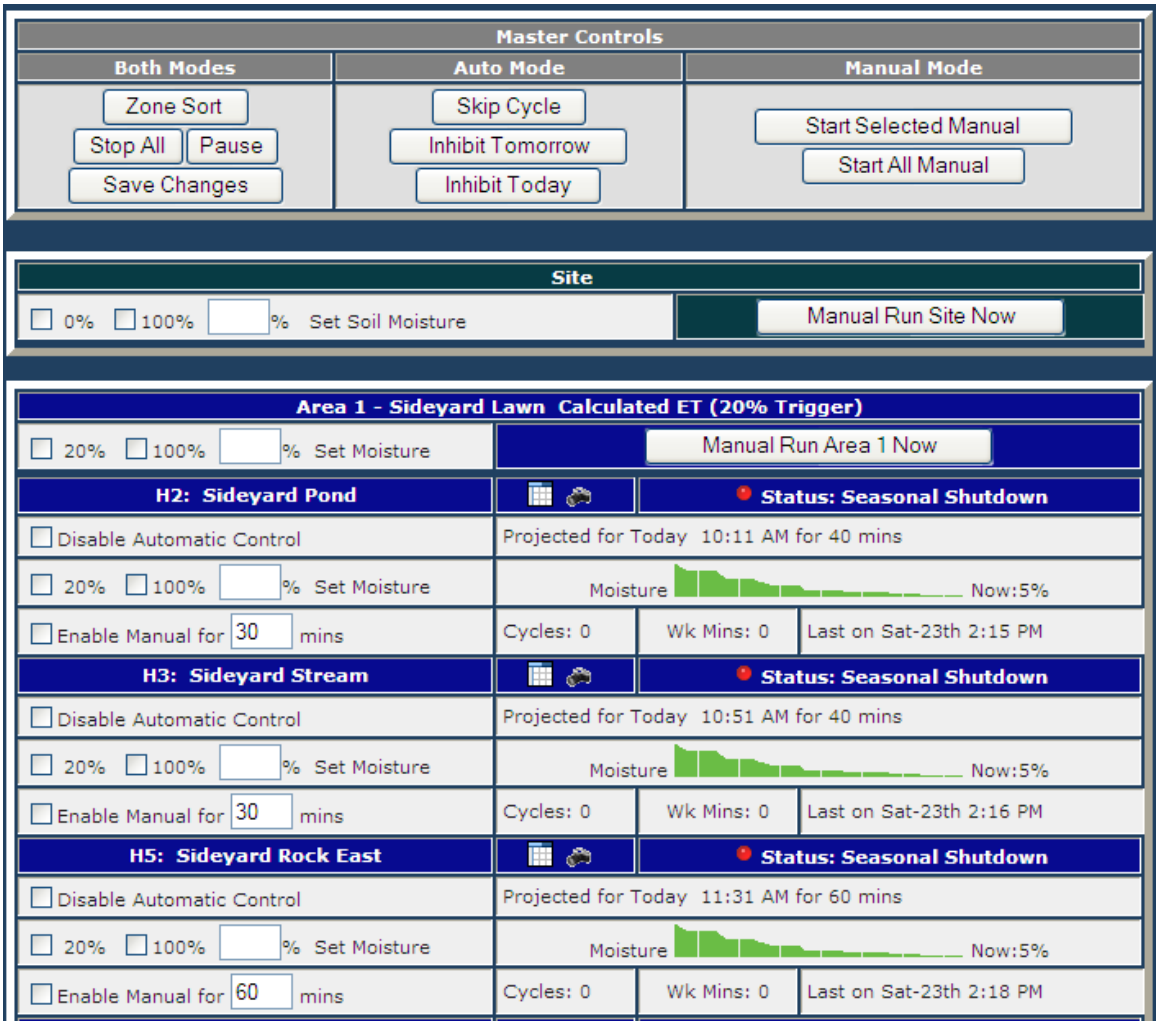


Figure 52 Zone Status Page View

The Sprinkler Control page provides a more complete view of the sprinkler status. It, along with VR, is the mechanism by which manual watering times can be specified. This view also enabled multiple zones to be scheduled for a manual cycle. In this case each zone to be enabled for manual control is indicated with a check in the enable manual control checkbox and the Start Manual button clicked to accept this request.

When the Area Sort button is used to provide zone organization by Area then additional controls are provided to start all zones within a specific area and to set the soil moisture levels for an area or for the entire site.

6.2 Remote with IPhone/IPad/IPod/Android

A general interface capability for remote access exists with browser-oriented interfaces that can be used with remote devices where firewall access has been provided to the mcsSprinklers HTTP server. Specialized Apps that run on Apple or Google phone or tablet platforms are also available. A landscape view provides the ability to gesture swipe through each zone or each area to provide manual control as well as observe current status. See Figure 53 . An up/down gesture toggles between Area and Zone views. The left/right gesture cycles through each zone or area. The zone identification is the zone picture on the center left and its scheduling information is in the middle right. The top contains the most recent message feedback. The bottom contains buttons that affect the operation. The WAN button is used to toggle between WAN vs. LAN server for the zone picture. If accessing from a remote location over the internet then the WAN should be selected. When a button is selected it will appear as depressed.

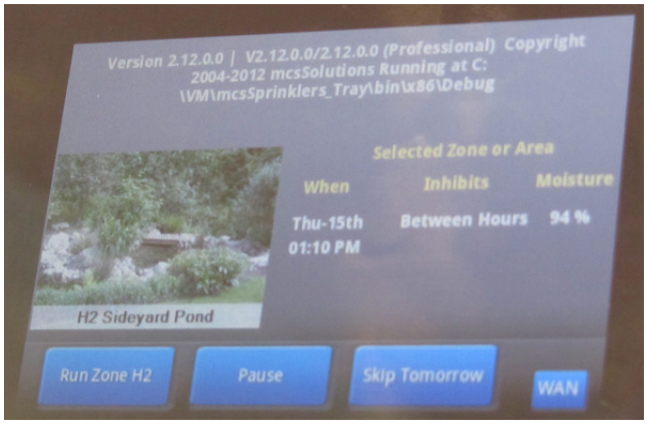


Figure 53 Phone App Landscape Remote

A portrait view is used to observe the next scheduled zone. See Figure 54. The swipe gesture has no effect as the next scheduled zone is not dependent upon user action. A Pause button is provided for the case where user inhibit of this and any other zones can be performed.

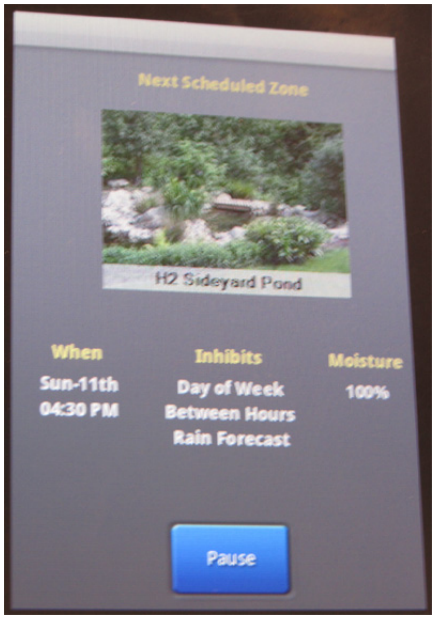


Figure 54 Phone App Portrait Remote

The installation of the Apps requires three pieces. One is the App itself that is available from Apple's or Google's marketplace that goes under the name iViewer 4 and was developed by Command Fusion. http://www.commandfusion.com. The Android iViewer client is not as mature as the one for Apple products. A designer application is available from Command Fusion downloads and it is the mechanism by which the mcsSprinklers landscape and portrait views are downloaded into the phone or tablet. A screenshot of the designer with the upload service prompt is shown in Figure 55. The two views are available in the Command Fusion Designer Project File "mcsSprinklers.gui" that can be found in the \bin folder of the mcsSprinklers install.

A user is welcome to customize the layout of the two views prior to transferring to the phone or tablet, but the customization will be only cosmetic and not functional. For example, a new button could not be added since mcsSprinklers would not know about the function of that new button.

A dedicated port is used to communicate between the PC and the client. This port is setup on mcsSprinklers Other Page and it is also setup with settings on the client. The third location is on the download of the landscape and portrait skins from the PC to the client. Port 8019 has been used during testing. Note that mcsSprinklers or the download service of the designer can be connected to the port to the client, but not both at the same time. When downloading the skins to the client, mcsSprinklers should not be running.

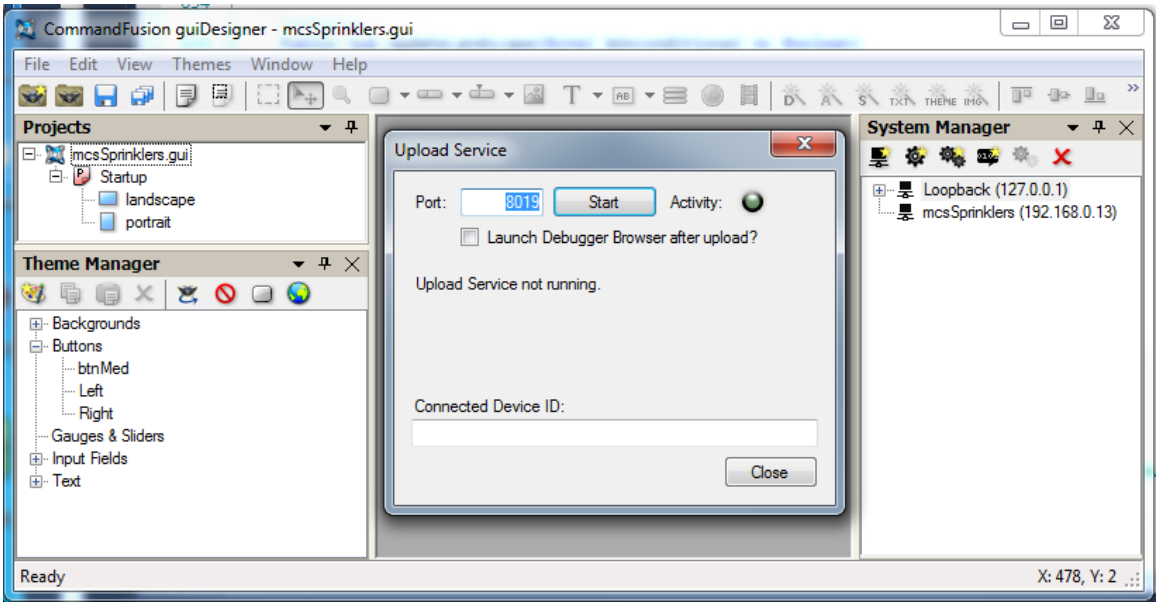


Figure 55 Command Fusion Gui Designer for Upload

The process to follow to setup the application consists of:

1. On some PC open CommandFusion guiDesigner after download from commandfusion.com
2. Select File and navigate to mcsSprinklers install folder \bin\mcsSprinklers\mcsSprinklers.gui
3. In the Projects panel in upper left right click on mcsSprinklers.gui and select Project Properties
4. Click F12 to start Upload Service.
5. On IPhone/IPad/Ipod, download iViewer (version 4) APP
6. From Settings select iViewer to get to application-specific settings
7. Select File URL to be PC LAN IP where guiDesigner is installed
8. Select Reload GUI layout
9. Exit settings and start iViewer
10. On the PC the Activity icon in upload services will blink and the GUI will appear on iViewer APP.

11. At some convenient time return to Settings and deselect the Gui Reload so that it will no longer transfer the GUI on each start of iViewer. The Upload Service on the PC can be stopped and the guiDesigner on the PC can be exited.
12. On Android the same process is followed as the Iphone/Ipad/IPod starting but step 6 access to application settings is from the iViewer application with the grid or vertical elipse icon in the tray at the bottom. Different Android OS versions may have different approach to changing application settings.

6.3 Remote with Palm pad or Power line Controller

Manual control of the sprinkler valves from a Browser or with Voice can be achieved without any additional setup. In the case of the handheld remote additional setup is required to associate a remote control code with a zone. This association is done from the Setup7-Remote Control page. This page is shown in Figure 57. In this example remote codes N2 and N10 are associated with the Garden and Lawn zones, respectively. The use of the handheld remotes ON and OFF buttons will now have the same functionality as the individual zone ON/OFF buttons on the browser pages.

In addition to this association there also needs to be a mechanism by which the PC can recognize the remote control codes that are being transmitted. The W800 interface is able to perform this function. It can be run on any PC on the Local Area Network including the local PC. If from the local PC then selecting the checkbox can automatically start it shown on Figure 29 of the Setup9-Others page.

The normal use is with the internal interface using the com port assignment made on the Setup7-Remote page per Figure 56. There are three text box entries available. If the W800 is connected to a serial port on the same computer as mcsSprinklers then the W800 IP text box is left blank and the port number is placed in the W800 port box. This will be a number such as 1, 2, etc. If the W800 is interfaced via the LAN then the IP and port are entered in these two boxes such as is shown in Figure 56.

RF transmissions such as from a palm pad actually send the same command multiple times with each push of the button. It is done to assure that at least one reaches the receiver. To assure that only one is received the extra ones are filtered-out for a short period of time. This filtering interval is the Debounce Period entry. The value of 1000 means that the same button press will be ignored for one second. If the value is reduced to 500 then two of the same button pushes within one second will be accepted.

Figure 56 W800 Port Selection for Internal W800 Connection

The same remote functionality is achieved with an X10 mini/maxi controller that provides a set of buttons that can be activated to send codes over the power line. In this case the W800 interface is not needed. The CM11A that is used to drive the power line will also function to listen to commands.

Disable Direct Valve Control	Disable Alias Valve Control
☐ Disable Remote Direct Valve Control	☐ Disable Remote Valve Control via Alias

Remote Control Activation Setup		
Zone	**Valve**	**RF Code**
Rain8_Unit__Valve	X10 H- Valve 1	I1
Rain8_Unit__Valve	X10 H- Valve 2	I2
Rain8_Unit__Valve	X10 H- Valve 3	I3
Rain8_Unit__Valve	X10 H- Valve 4	I4
Rain8_Unit__Valve	X10 H- Valve 5	I5
Rain8_Unit__Valve	X10 H- Valve 6	I6
Rain8_Unit__Valve	X10 H- Valve 7	I7
Rain8_Unit__Valve	X10 H- Valve 8	I8
Rain8_Unit__Valve	X10 H- Valve 9	I9
Rain8_Unit__Valve	X10 H- Valve 10	I10
Rain8_Unit__Valve	X10 H- Valve 11	I11
Rain8_Unit__Valve	X10 H- Valve 12	I12
Rain8_Unit__Valve	X10 H- Valve 13	I13
Rain8_Unit__Valve	X10 H- Valve 14	I14
Rain8_Unit__Valve	X10 H- Valve 15	I15
Rain8_Unit__Valve	X10 H- Valve 16	I16
Area 1 Status	H2,H3,H4,H5,H6,H8	
Area 2 Status	H1,H10	
Area 3 Status	H7,H9	
Area 4 Status	H11,H12,H15	
Area 5 Status	H13,H14,H16	

Figure 57 Remote Control Setup Page

6.4 Remote with Wireless Handheld PDA

It is possible to control mcsSprinklers valves with a small handheld computer such as a Palm. A special browser page is used to provide just the essential information necessary to accomplish this control. The URL to access this page is the URL of the computer and port where mcsSprinklers is running with the page parameter of "handheld". For example http://192.168.0.31:8008/handheld. The page presented is a condensed version of the General Status page where no graphics are presented and only devices that have control buttons are listed. The layout is shown in Figure 58. The screen width is tailored for a 320 pixel wide screen and no graphics are included so as to minimize the resources needed in the PDA. The four buttons in the top row can be used to sort the rows per the column title.

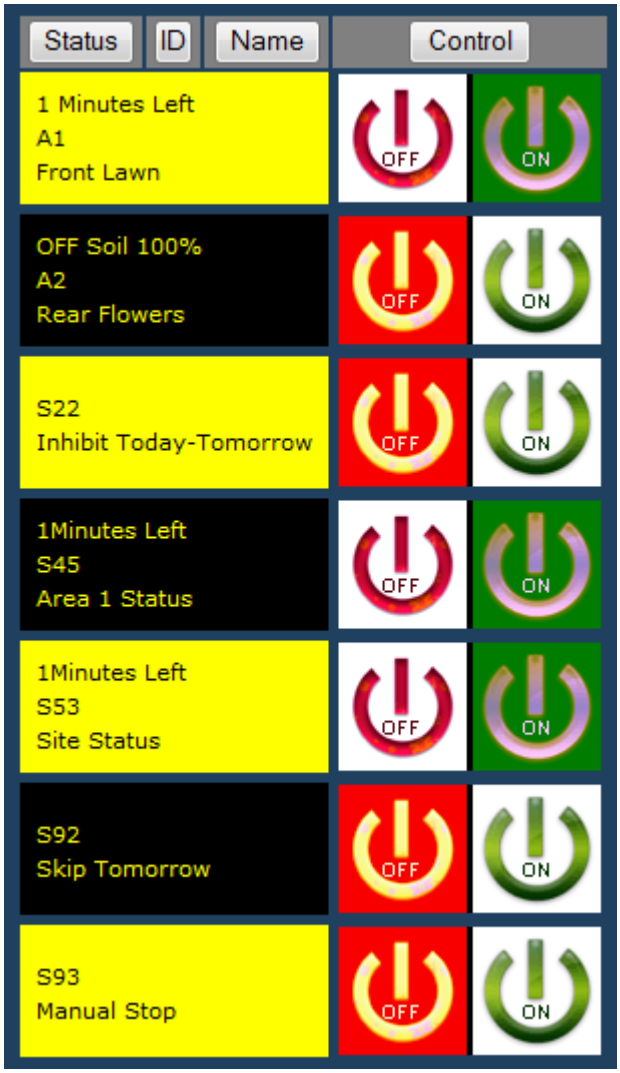


Figure 58 Handheld Remote Control Browser Page

When accessing mcsSprinklers from a PDA or other remote host the LAN firewall becomes a consideration. The firewall must allow this communication. In some cases it is possible to setup a rule to allow mcsSprinklers.exe to pass through the LAN or WAN firewall. In some cases it will require an advanced setup where the specific browser port (default 8008) needs to have the exception. See http://windows.microsoft.com/en-us/windows-8/windows-firewall-from-start-to-finish

6.5 Crestron Control

mcsSprinklers can be used in conjunction with a Creston system that has been configured for use with Rain8Net modules. Automatic water-saving control and remote internet access will be provided by mcsSprinklers and the Crestron touch screens can also be used for manual control of the zones or as an alternate automatic scheduling mechanism for a sequence of zones.

In this configuration the Crestron RS232 output is directed to a Serial COM port on the PC on which mcsSprinklers is running. This port is selected as the Crestron port on the Remote Setup Page per Figure 59. Note that a crossover RS232 cable will be required between the Crestron Processor and PC so that the RxData and TxData lines are swapped.

Figure 59 Crestron Interface Port Selection

6.6 Voice Control

Voice can be used to command a zone on or off and obtain status of the currently running zone or the next zone scheduled. A sprinkler zone is identified by its named location. These location names were previously completed on the Setup2-Wiring page as shown in Figure 18.

The syntax of the voice commands is itemized in Table 3. Examples of their use are also shown in the Voice column on the Setup7-Remote Control page per Figure 57. When duration is specified it must be in minutes. Single minute increments up to 20 and then five-minute increments up to 95 are accepted.

Table 3 Voice Recognition Commands

Objective	Voice Command
Obtain status of active zone, or next scheduled zone and any inhibits that are active	Sprinkler Status
Turn off a sprinkler zone	Turn Off ZoneName
Turn off a sprinkler zone	Turn ZoneName Off
Turn on a sprinkler zone for a 20 minutes	Turn On For 20 Minutes ZoneName
Turn on a sprinkler zone for a 20 minutes	Turn ZoneName On For 20 Minutes

The voice command can come from either a microphone on the local PC or on one from another PC on the LAN. In the LAN-activated configuration the xapmcsVoice.exe program must be running on the computer with the microphone.

A voice command can also request status. The computer will respond will identification of any zone that is currently running and the projected next start time of the other zones.

7 Status Reporting

Status is available from the two browser pages from which manual control is performed, from the run list page and via computer generated speech in response to the voice status request. A tray icon is also used to provide a quick status from the local desktop. The icon appears as a colored base with water drops spewing upward. The base is green with one or more zones are being irrigated. It is yellow then a Message Page entry has been made for notification. It is blue at all other times.

7.1 General Status

The General Status page provides current status for over 70 aspects of the scheduling. Most of the status fields will be obvious by their name. The Predicted Rain and Predicted Evaporation are a composite of 3 days of rain/evaporation data and these are the values used to base calculated control strategy actions. ET is a one-hour Evapotranspiration index. Max Light and One Day Rain reflect the maximum solar intensity and maximum one-day rainfall that was measured in the last 30 days. If none is measured then this value will typically be 0.5 inch. The Forecasted levels are based upon these maximums.

The top segment of the status reporting is shown in Figure 50. This page has column header buttons that can be clicked to sort the order of the reported status. Each status line contains a graphic or textual representation of the status in the first column and a description of the status being reported in the others. Often the status field is blank and it indicates an inactive situation. The color of the zone valve and the pump change to red when a communication failure occurs. This applies to the Rain8-Net since it provides a positive feedback of status. When a zone is delivering water then the status icon is animated. The tray icon also changes color to green when a zone is being watered.

The calculation of ET is dependent upon internet data with particular attention given to UV (S78) and Temperature (S69). If these values are not updated with internet data then the moisture calculations will not be accurate and could result in incorrect watering cycles if the Area is using the Calculated ET control strategy. Status devices S87 and S88 provide feedback as to when the last Forecast data and Weather data has been received.

The General Status page also provides clickable access to additional information. Icons that precede a name indicate that a picture is available for viewing about that name. See 7.2 for more information about pictures. Icons in the status column that look like a calendar can be clicked to provide the 90-day history of that item. See section 7.3 for more information about the history presentation.

Figure 60 illustrates the method for producing a customized General Status view. This allows selected status devices to be hidden so the status views will show only those pieces of information that are of interest. When the “View All / Hide Selected” button at the top of the page is toggled the Hide (H) column will be presented. This column contains checkboxes to allow rows to be selectively hidden. After all desired customizations have been made then the “Save View” button is clicked to retain the settings. When the “Hide Selected” button is clicked then only those rows with unchecked Hide column checkboxes will be shown. See Figure 50 for view of the General Status after customizations have been exercised.

The General Status view also provides a method to tailor the touch screen page view for the professional version. The touch screen shows six measurements such as temperature and rainfall. The selection of the six to be viewed from the touch screen page is made from the “T” column of the General Status page. The first six selected sensors from the checked “T” column will be used on the touch screen page.

Note that when the Hide column is visible the General Status page will not refresh automatically. This allows undisturbed editing of the checkboxes.

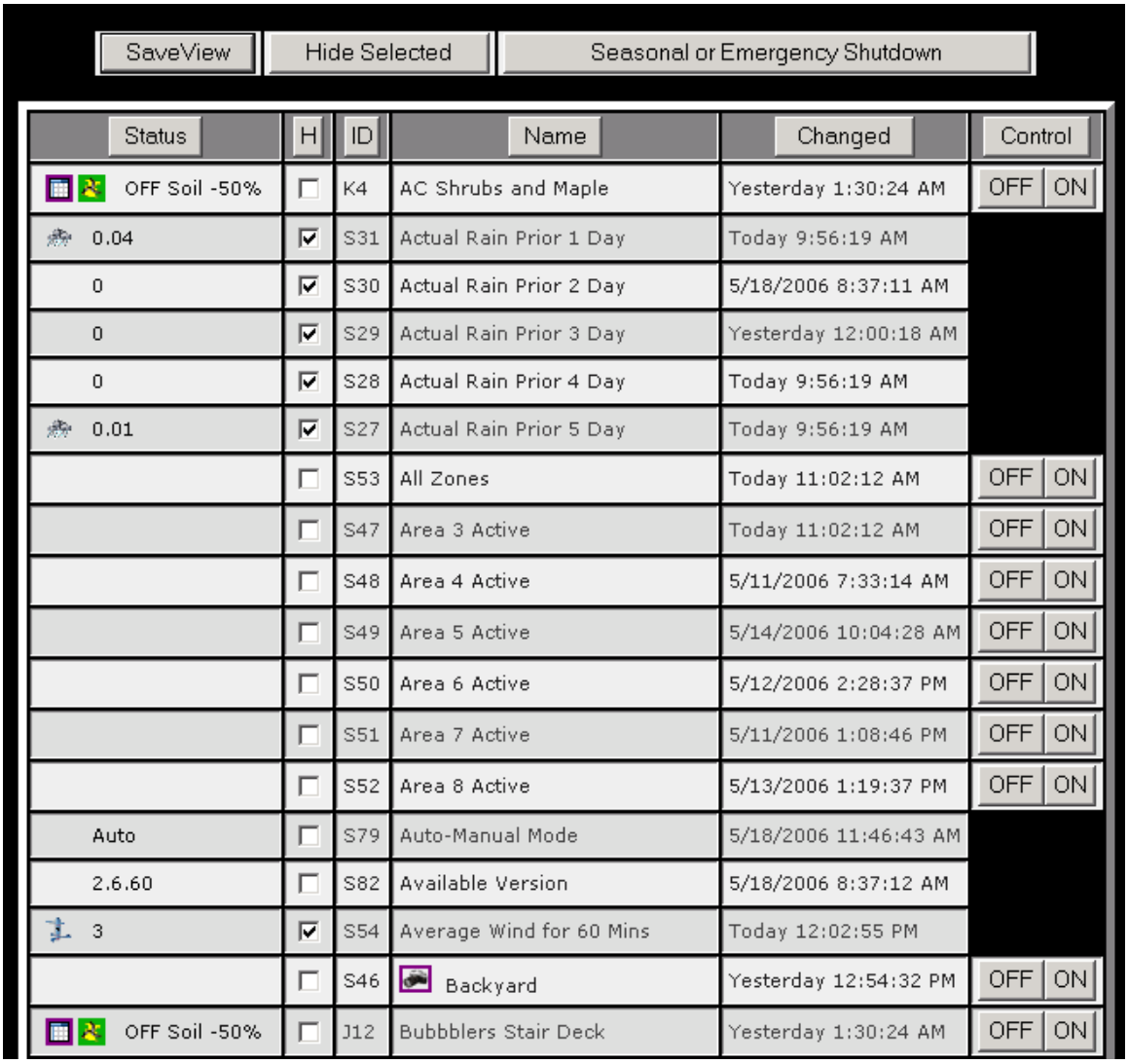


Figure 60 General Status Customizations

7.2 Reference Pictures

mcsSprinklers provides the facility to manage drawings and pictures that are provided by the user. These pictures will provide a visual for the site, for an area, for a zone, or for wiring. The picture is presented as a browser popup window and is produced when a camera/picture icon is clicked. As an example observe the popup window and the picture icon for device S46 in Figure 61.

During startup of mcsSprinklers it will look in the relative folder path " \HTML\mcsSprinklers\Pictures\" where the base folder is the install folder of mcsSprinklers which is typically "C:\Program Files\mcsSprinklers". Any .jpg, .png, or .gif file that it finds in that folder that has the same name as the name of a wiring harness, site, area, or zone will be used as picture icons on the General Status, Zone Setup, or Wiring setup pages. If the touch screen view is going to be used then only .jpg files should be used to identify the zones and areas.

The Site name is entered on the Others Setup Page. The Wiring Harness names are entered on the Wiring Setup Page. The Area names are entered on the Zone Setup Page. In the example of Figure 61 the Area 2

name entered on the Zone Setup page is “Backyard”. The file “Backyard.jpg” exists in the folder “C:\Program Files\mcsSprinklers\HTML\mcsSprinklers\Pictures\”. Note there was also a file of the name “Front” and one of the three accepted file types in the same folder since device S45 Area 1 name is Front.

The search for picture files only occurs during startup because it also reads the file contents to determine its size. The processing time to perform this size analysis is undesirable to be repeat for each setup change. This means that after the site, wiring, area, and zone names have been entered there will be a restart of mcsSprinklers needed before the associated pictures will be recognized.

mcsSprinklers will also allow the pictures to be identified as part of the setup on the Wiring, Zone and Other setup pages. In this case they can be located anywhere on the LAN and mcsSprinklers will provide a browse capability to locate them. It will then move them and rename them into Pictures folder. In this case no restart of mcsSprinklers is needed after pictures are identified.

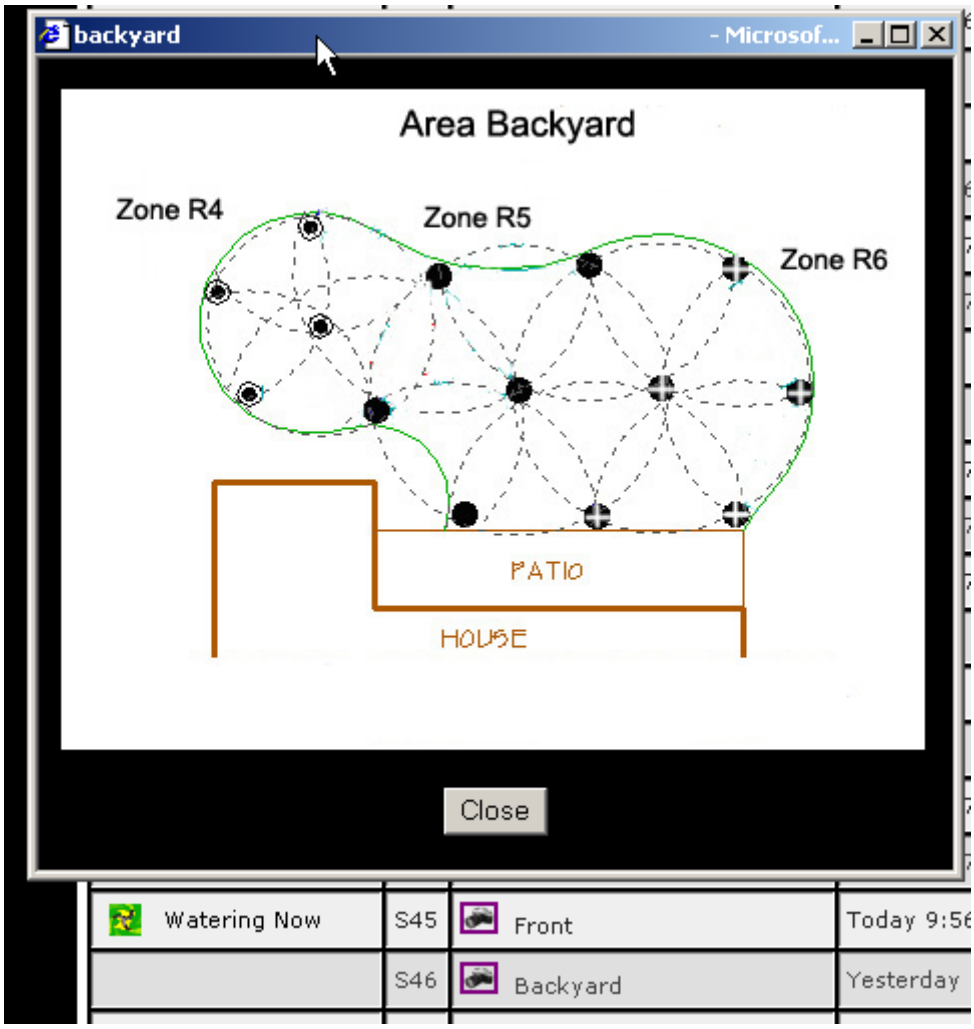


Figure 61 Reference Picture Popup

7.3 History Calendar

The Zone and sensor history is viewed in a calendar format for the last 90 days plus future days up to the next projected watering day for the zone. The calendar is a popup that is accessed by clicking on the calendar icon for a zone or sensor from the General Status page or Zone Status page. The number of days to display is a user preference item that can be changed from the Other Setup page.

The calendar presents a seasonal view of the irrigation history. More detailed information is shown when the day in the calendar is clicked. A broader annual trend is viewed by clicking the "Annual" button at the bottom of the calendar. A sample annual trend chart is shown in Figure 62.

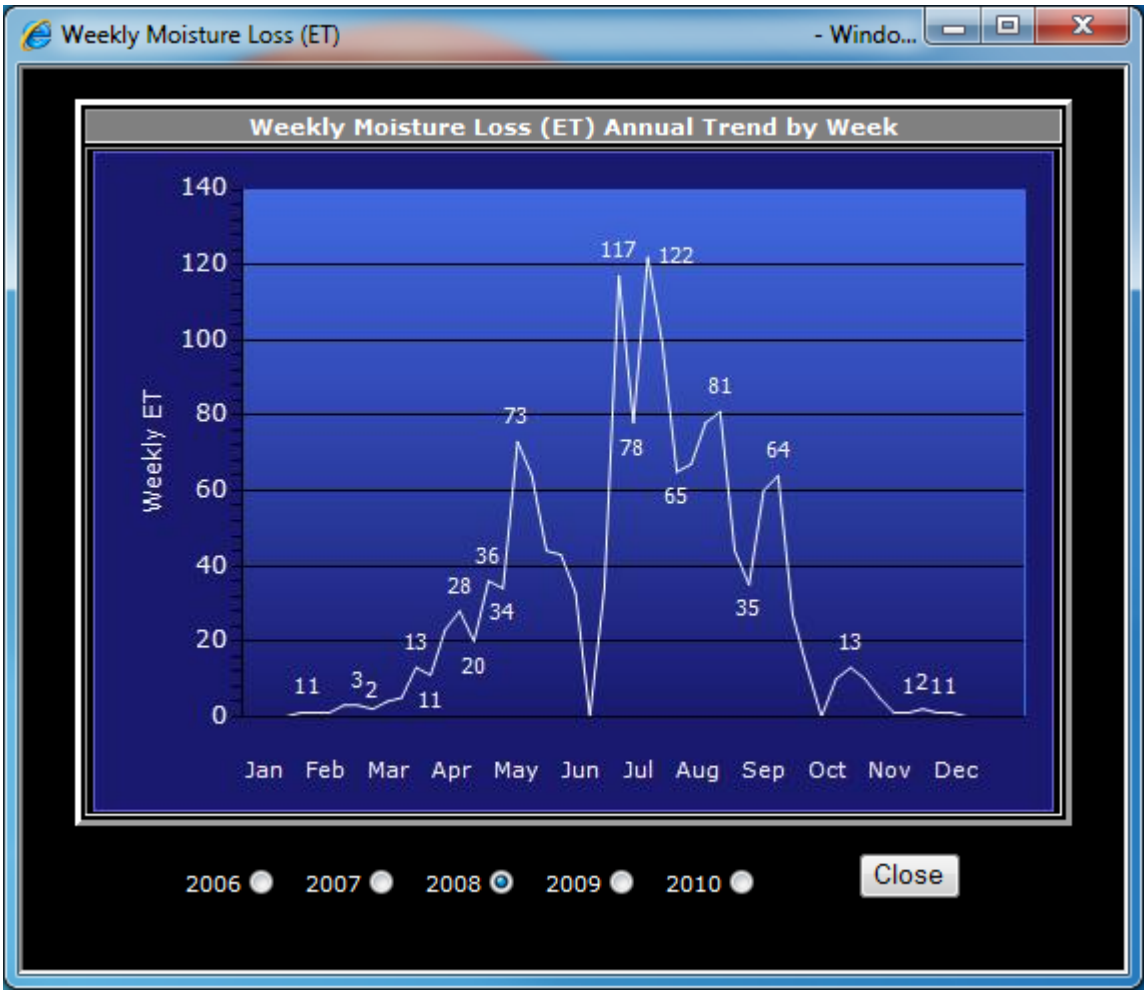


Figure 62 Annual Trend Popup

The sensor calendars will show the daily sensor measurement. Depending upon a sensor this will be the cumulative or the maximum sensor value for the day. A monthly value is also presented in the header of each calendar month. When the day in a cell is clicked then an hour-by-hour accounting of the sensor is provided in a detail popup. These two popups are shown in Figure 63.

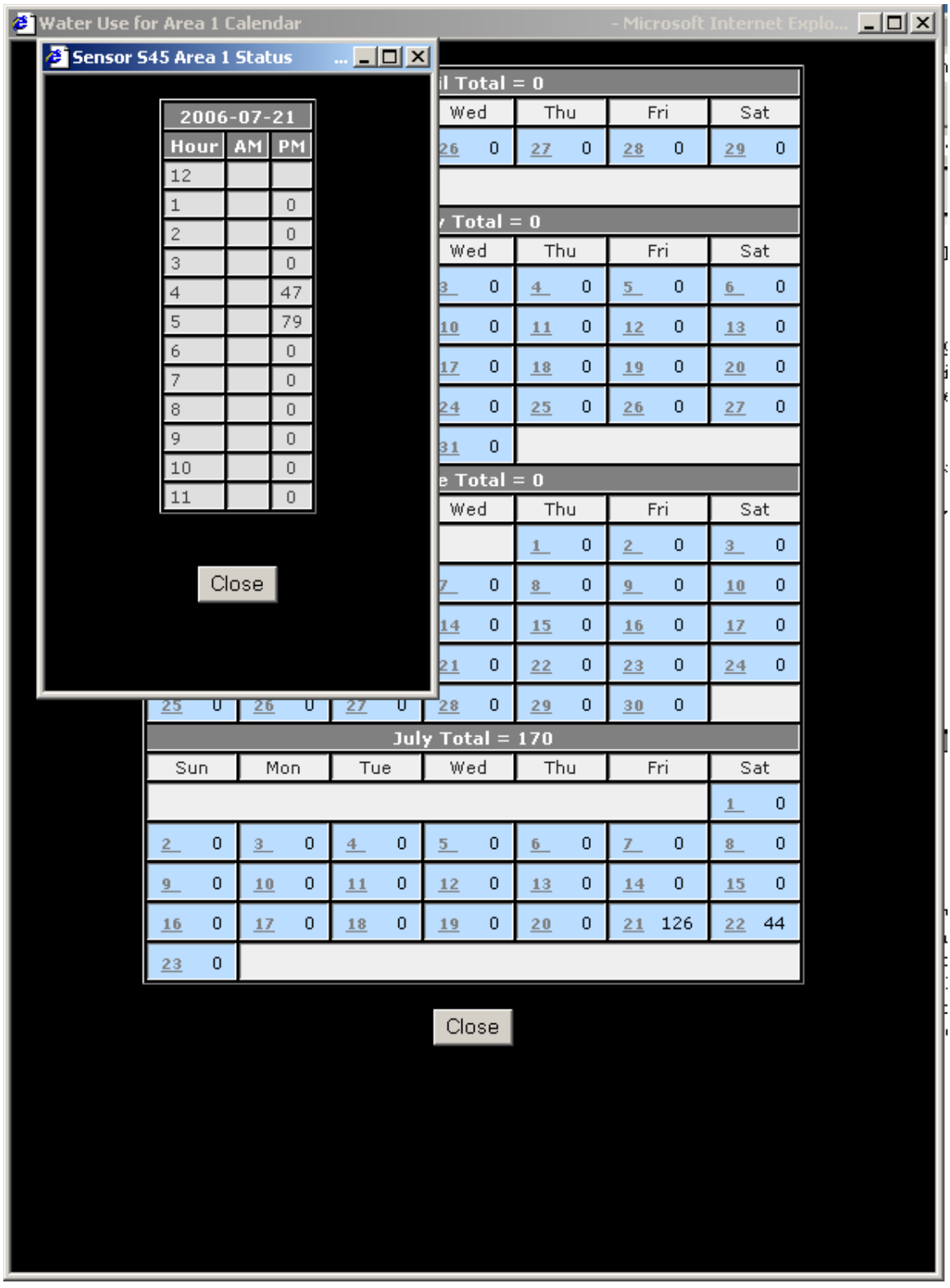


Figure 63 Sensor Calendar with Popup Detail

The zone calendars have three options available. The status option show irrigation days, rainfall days, and forecast using icons. Figure 64 shows a typical zone calendar in the status mode. A green sprinkler icon is

shown for each day the zone was run. A blue raindrop will be shown for each day where rainfall occurred. The future days will be shown with the weather icon and/or blue sprinkler icon for the projected next irrigation day. The mid-day current weather condition icon will be shown in lieu of the raindrop icon when no rain was recorded for the day if the icon source is selected on the Weather Setup Page. When a calendar cell in the area reserved for an icon is clicked a detail popup is presented. The information in this popup shows the statistics for the zone for the selected day as well as the total time that the zone has operated.

The zone calendar includes a radio button selection to change the zone view from status to either run minutes or water use for the zone. The calendar's presented for these other two modes will use a format similar to the sensor calendar.

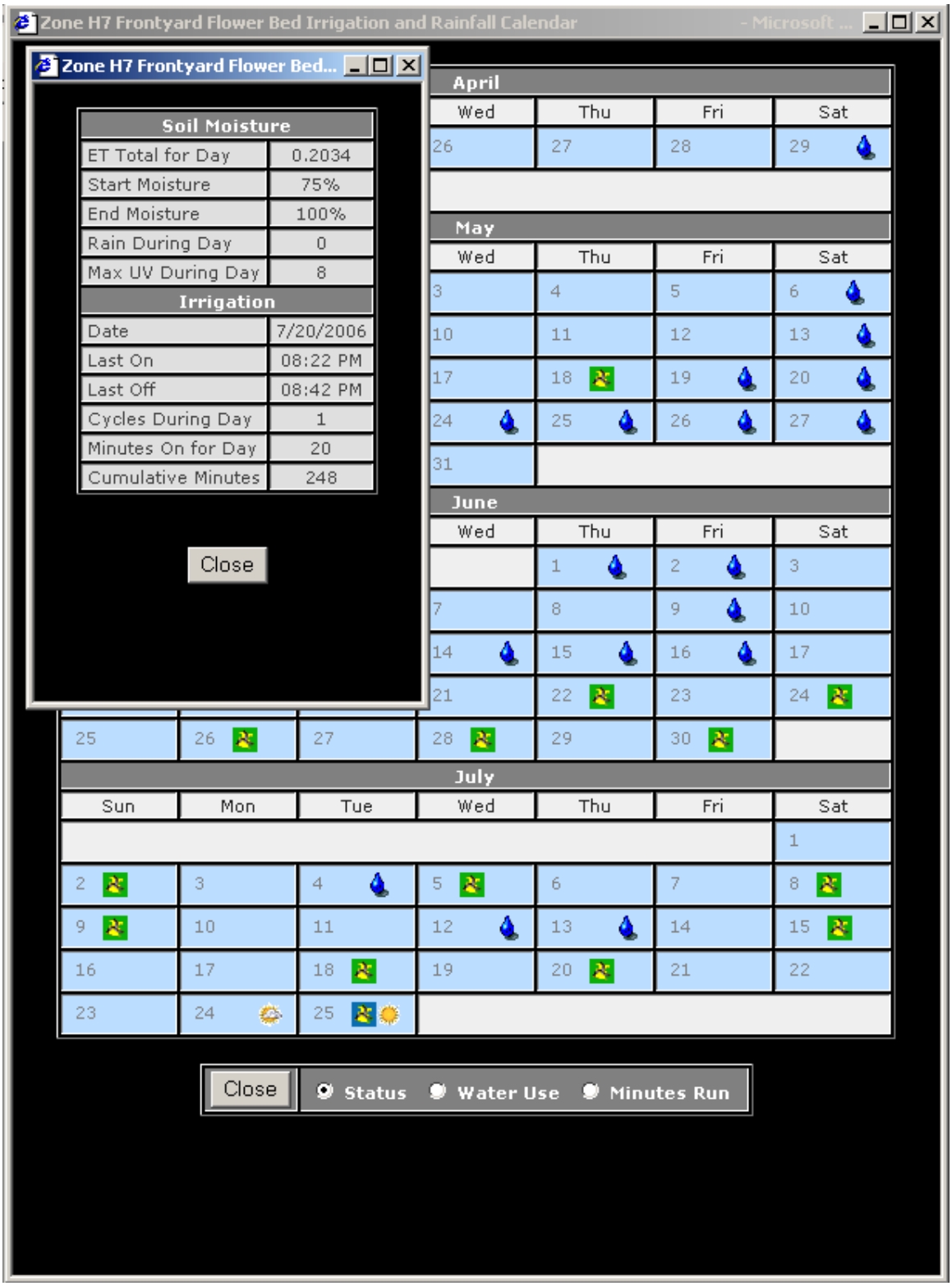


Figure 64 Zone History Calendar Popup

7.4 Zone Status

The zone status page is shown in Figure 52. Ten pieces of information are provided for each zone. At the top in the Area header bar is the area to which it belongs and the Control Strategy for this area. This information is only provided on the Area Sort.

The Zone header contains the Device Code and Name of the device, the zone's watering status with both a color dot and description, number of minutes for which it has been watered during the week and the calculated moisture level of the soil in this zone.

The control status is shown by a color dot and text description. The colors can be as follows:

- Blue – watered earlier today
- Green – watering now
- Yellow – to be watered within the next day
- Red – not to be watered within 24 hours

When blue, the zone is prevented from watering again today, but the web page will show a checkbox that resets this condition for any Blue dot zone. This checkbox can also be reset via use of the Alias device setup on the Area Tabs.

The day and time of the next predicted water time is shown for each day. If the control strategy is time-based then the prediction should be accurate. If the control strategy is closed loop then the accuracy will be greater as the next watering time approaches. It is also dependent upon the quality of the parameters provided to calculate soil moisture and the quality of the weather forecast.

Zones can be deselected from automatic control with a checkbox entry. It will retain this "disabled" status until the checkbox is cleared.

The two rows in the left column are used to enable and disable automatic and manual control respectively. Automatic control times are done in the Area Tabs of the setup page and can be changed from the web view in the text box on the first row of the zone information. The number entered is an integer number of minutes. Manual control times are done with the text box on this web view.

The prefix to the automatic control time text box is the predicted time when the zone will next be run based upon the current parameters defined for sprinkler control. Below this predicted next watering time is the actual last watering time.

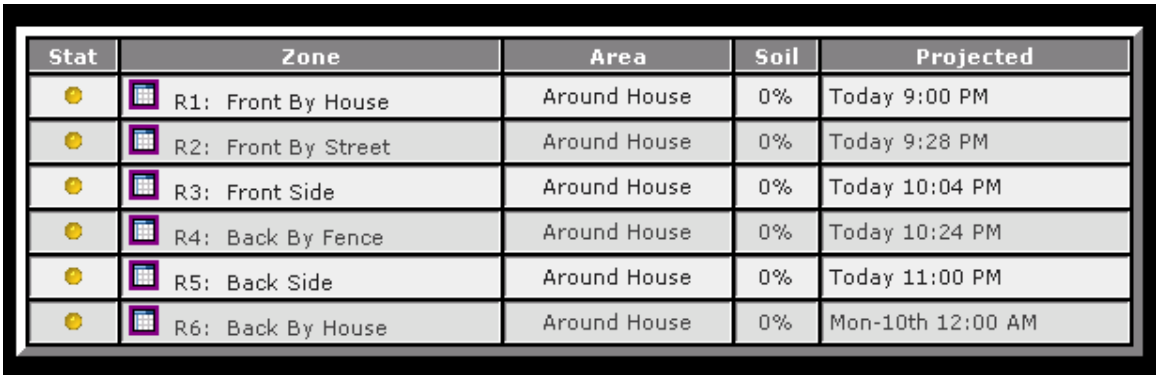
If the zone has been watered today then another checkbox will appear to the right of the last watering time. If this checkbox is checked, then this zone will again be enabled for watering today.

On the right is a graphic showing the moisture level over the last seven days. It is scaled with the control threshold as the minimum level and 100% as the maximum. The current moisture level graphic is also shown.

7.5 Run List

The run list is a view that shows the projected watering time for all enabled zones. It is sorted in order of run time to provide a quick view of the sequence that is projected based upon the control strategies and current conditions. The page can be seen in Figure 65.

The Status indication will typically be green when a zone is running and yellow or light blue depending upon how far into the future the projection is. The zone name includes a clickable icon to get to the calendar view of the zone for a history of that zone's activity. The remaining columns show the information about the zone and its projected next watering time.



Stat	Zone	Area	Soil	Projected
	R1: Front By House	Around House	0%	Today 9:00 PM
	R2: Front By Street	Around House	0%	Today 9:28 PM
	R3: Front Side	Around House	0%	Today 10:04 PM
	R4: Back By Fence	Around House	0%	Today 10:24 PM
	R5: Back Side	Around House	0%	Today 11:00 PM
	R6: Back By House	Around House	0%	Mon-10th 12:00 AM

Figure 65 Run List Page

7.6 Priority Messages

When mcsSprinklers is trying to provide notification of an unusual situation then it will provide a popup from the tray icon. This occurs when internet data update has stopped, a change in the active redundancy occurs, irrigation could not complete for the day, or a significant unexpected software event.

The log of message since the start of the mcsSprinklers session can be viewed by either of two means. One is via the messages option when the tray icon is clicked. The messages can also be viewed from the browser interface by selecting the Messages link at the top of each page. A page similar to Figure 66 will be shown.

The messages are also contained in the mcsSprinklers subfolder HTML\mcsSprinklers\Data\StartupTrace.txt and can be copied for other reference. This file is created at each mcsSprinklers startup so if a copy is desired then it must be made before a restart.

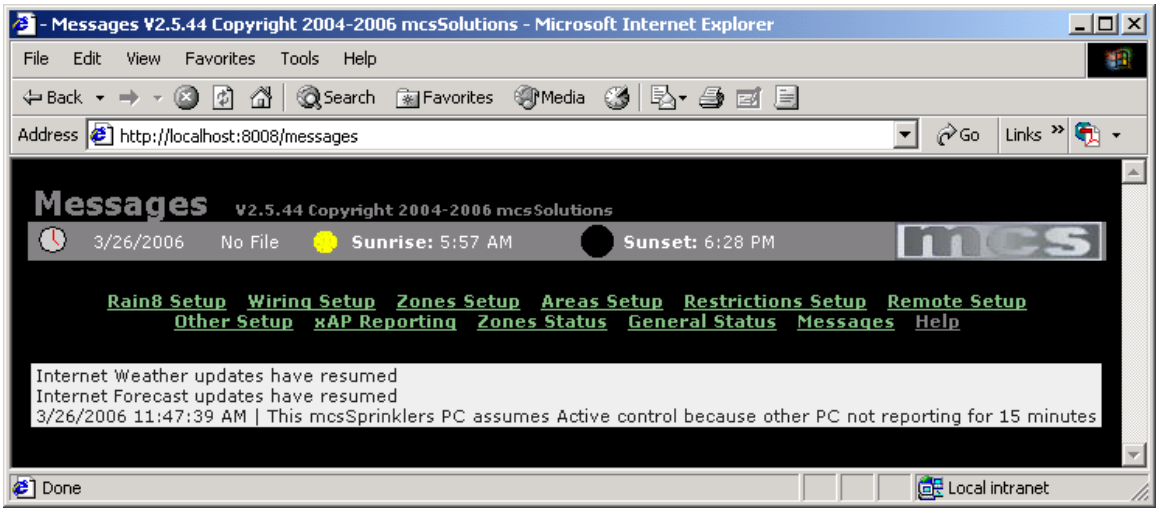

- Messages V2.5.44 Copyright 2004-2006 mcsSolutions - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address http://localhost:8008/messages
Go Links
Messages V2.5.44 Copyright 2004-2006 mcsSolutions
3/26/2006 No File Sunrise: 5:57 AM Sunset: 6:28 PM
mcs
Rain8 Setup Wiring Setup Zones Setup Areas Setup Restrictions Setup Remote Setup
Other Setup xAP Reporting Zones Status General Status Messages Help
Internet Weather updates have resumed
Internet Forecast updates have resumed
3/26/2006 11:47:39 AM | This mcsSprinklers PC assumes Active control because other PC not reporting for 15 minutes
Done
Local intranet

Figure 66 Priority Message Page

Priority messages can be viewed at any time. An Email notification can also be provided when such a message occurs. This notification is setup on the Other Page with the notification setting shown in Figure 68. When the message is delivered it will contain the message in the subject of the email and the entire contents of the log in the message body. The same email can also be sent to mcsSprinklers.com to assist in product support by selecting the CC checkbox on the email notification section. Email messages are

limited to one per 60 minutes. The message will provide notification of potential action necessary. A more complete accounting of items needing attention can be viewed from the Message Page.

mcsSprinklers delivers Email directly to your Email server. Some Email servers require authentication with user name and password and some use POP for the login. If your Email Server requires either of these then the appropriate fields in the email notification need to be entered. One approach to assess what is required is to observe how your email client is setup (e.g. Microsoft Outlook) to send and receive email. The same settings used there will be used here. If you use Outlook you can view the settings starting at the Outlook menu, Tools/Options/Mail Setup/Email Accounts/View Existing/Select Account/Change to bring up the form such as shown in Figure 67. Note that for mcsSprinklers the Outgoing server (SMTP) is the one of interest. mcsSprinklers does not accept external email so the Incoming server name is not needed in the mcsSprinklers setup. Different versions of Outlook and different email clients will have different methods to setup the email account, but the SMTP server and logon information is usually included as part of its setup.

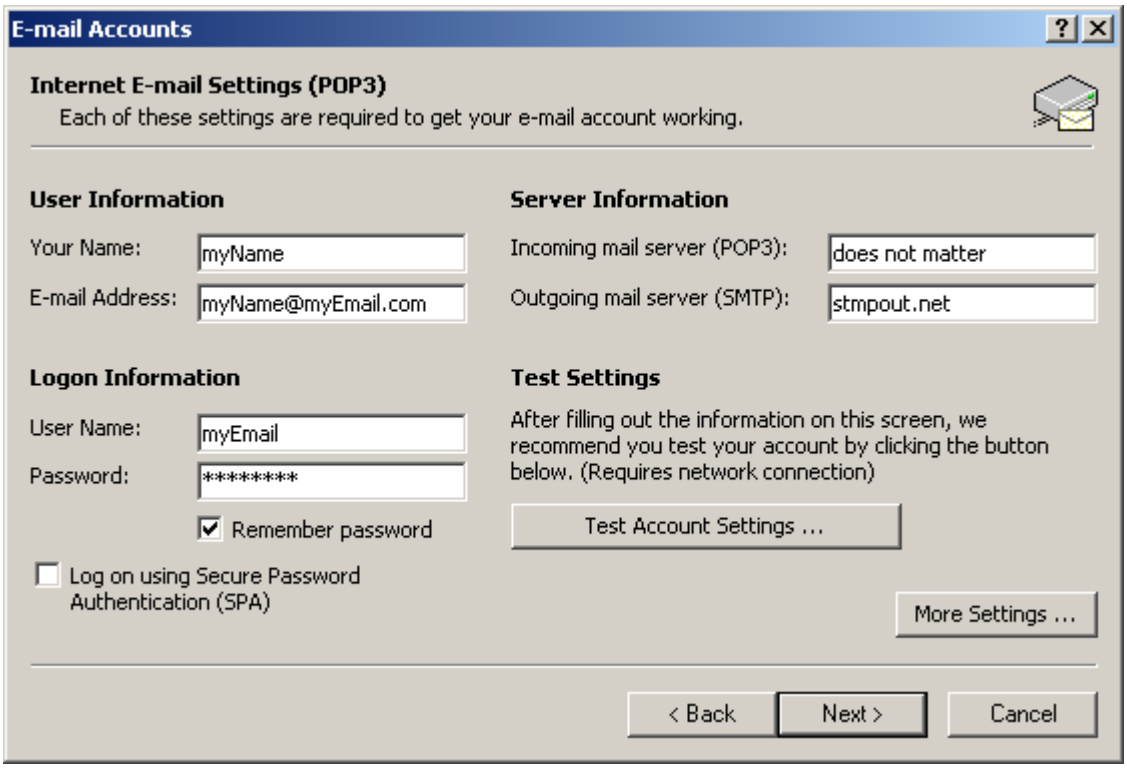


Figure 67 Typical Outlook Email Settings

The "Send a Test Email" button can be used to try the settings that you have entered. If success you will receive an email message. If there was a problem then the information provided by your Email server will be visible from the Messages Link or Messages Menu item.

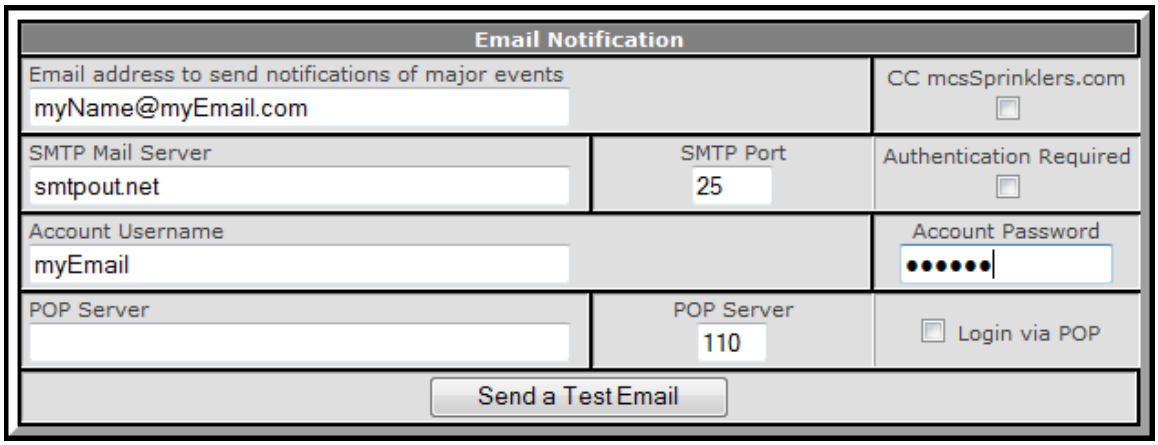


Figure 68 Email Notification of Major Events Setup

7.7 Log of Valve Control

Each valve control action is logged in a database and this log can be reviewed to provide evidence if a zone has been run. The log is accessed from the "Log" browser link at the top of each page. It will show the sequential record of each valve action over the past week. Figure 69 shows a typical log. The order can be sorted using the Time, Valve, Location, or Status buttons. The view can be restricted to less than seven days by entry of a Since date and using the Log Since button. The entire log can be deleted with the Clear Log Button.

The Control Log selection as part of the Miscellaneous Options on the Site Page is available to toggle the inclusion/exclusion of the STATUS_REQUEST and response in the log. This selection is shown in Figure 41.

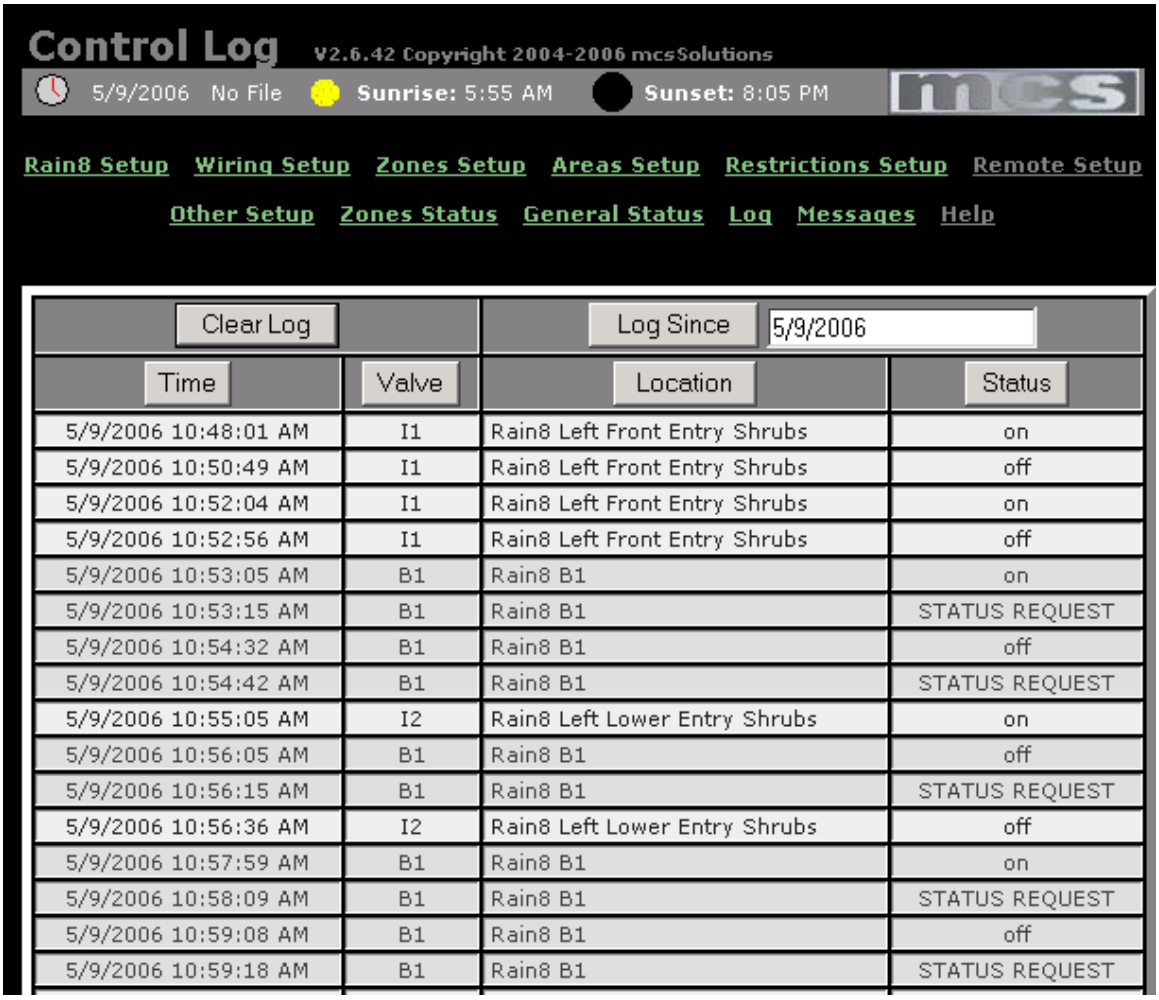

Control Log
V2.6.42 Copyright 2004-2006 mcsSolutions
5/9/2006 No File
Sunrise: 5:55 AM
Sunset: 8:05 PM
mcs
Rain8 Setup
Wiring Setup
Zones Setup
Areas Setup
Restrictions Setup
Remote Setup
Other Setup
Zones Status
General Status
Log
Messages
Help
Clear Log
Log Since
5/9/2006
Time
Valve
Location
Status
5/9/2006 10:48:01 AM I1 Rain8 Left Front Entry Shrubs on
5/9/2006 10:50:49 AM I1 Rain8 Left Front Entry Shrubs off
5/9/2006 10:52:04 AM I1 Rain8 Left Front Entry Shrubs on
5/9/2006 10:52:56 AM I1 Rain8 Left Front Entry Shrubs off
5/9/2006 10:53:05 AM B1 Rain8 B1 on
5/9/2006 10:53:15 AM B1 Rain8 B1 STATUS REQUEST
5/9/2006 10:54:32 AM B1 Rain8 B1 off
5/9/2006 10:54:42 AM B1 Rain8 B1 STATUS REQUEST
5/9/2006 10:55:05 AM I2 Rain8 Left Lower Entry Shrubs on
5/9/2006 10:56:05 AM B1 Rain8 B1 off
5/9/2006 10:56:15 AM B1 Rain8 B1 STATUS REQUEST
5/9/2006 10:56:36 AM I2 Rain8 Left Lower Entry Shrubs off
5/9/2006 10:57:59 AM B1 Rain8 B1 on
5/9/2006 10:58:09 AM B1 Rain8 B1 STATUS REQUEST
5/9/2006 10:59:08 AM B1 Rain8 B1 off
5/9/2006 10:59:18 AM B1 Rain8 B1 STATUS REQUEST

Figure 69 Log of Prior Week Valve Actions

8 Interface Details

8.1 Rain8 Module Control

8.1.1 Rain8-Net

The Rain8-Net is managed directly via a serial port on the local PC. A valve command is delivered, the Rain8-Net acknowledges the commanded valve state, and mcsSprinklers status devices are updated. Three retries will be performed should the expected acknowledge not be received. After three retries the valve status will be set to Fail. In a Homeseer configuration the fail status will be observed as Unknown status.

For Rain8Net devices connected through IP/Serial adapters, mcsSprinklers will cycle power on these devices when a connection is lost and cannot be reestablished. To take advantage of this capability there needs to be a device such as an appliance module that can be controlled by X10, UPB, xAP or Homeseer device.

8.1.2 Rain8-Wireless

The Rain8-Wireless is managed via a local serial port, via xAP-X10 command, or the Homeseer X10 interface should this Homeseer interface support RF X10. In all cases the command is delivered and mcsSprinklers status updated at time of command. There is no confirmation of the commanded state.

8.1.3 Rain8-X10

Rain8-X10 control operations are the same as the Rain8-Wireless.

8.1.4 Rain8-X10-2

When the Rain8-X10-2 is connected to the local PC port managed by mcsSprinklers then the Rain8-X10-2 module should be configured to provide an acknowledge on command. mcsSprinklers will expect the status acknowledge from the Rain8 and retry and report fail status as is done with the Rain8-Net. mcsSprinklers status is only updated on receipt of Rain8-X10-2 status.

When the Rain8-X10-2 is controlled by another interface then it should be configured to provide status only when polled. This will reduce the potential for power line collisions that can occur when the controlling interface is not expecting the immediate status response. In these cases mcsSprinklers will issue a Status Request thirty seconds after the command was issued. While other power line activity may be occurring at this time, there will not be any other mcsSprinklers power line commands at this time. mcsSprinklers status is updated on command as is done with the Rain8-X10, and if the response to the Status Request is different than the command then the mcsSprinklers status will be updated to the reported status.

8.1.5 EtherRain

The EtherRain is connected to the local PC via a LAN connection using an IP address. The EtherRain module is managed as a set of eight valves. When communications are lost to the module then all eight valves are considered failed. Two retries are used for each communication attempt before failure is declared.

8.1.6 Homeseer Virtual Devices

When the Homeseer interface is used for X10 or other virtual devices then mcsSprinklers will use the status provided by Homeseer. mcsSprinklers status will be updated on command and changed if Homeseer provides a later change of status. Commands going through the Homeseer interface will occur no faster than one command per 3 seconds. This is done to minimize the chance of power line bandwidth overutilization.

8.2 Alternate Sensor Interface

8.2.1 Weather Data

Weather data can be obtained from a variety of sources that are selected on the Setup8 - Weather Page. These can be from the Internet from AccuWeather, US National Weather Service, WeatherUnderground, and AWS. It can be obtained via the LAN using xAP message schema Weather.Report or xAPBSC. It can be obtained from the LANs file system using a text file in a comma-separated-values format. It can also be obtained from Homeseer virtual devices when interfaced via Homeseer.

Weather information is expected from the xAP interface using the Weather.Report schema for both localized current weather and the more general Forecast. Should either of these sources become stale, mcsSprinklers will initiate the collection of data from the Internet. The xAP priority exists because some environments use xAP to obtain data from the internet and the priority schema reduce the internet access traffic.

Forecast data will be obtained no more often than once per 30 minutes. AWS or WeatherUnderground data will be obtained on 5 minute intervals except when Wind in selected as a restriction criteria and then it will be done on 1 minute intervals. The AWS or WeatherUnderground data will be obtained from the primary source when available. After three “no reports” from that site the secondary and then tertiary site will be used.

Since weather and forecast data is obtained from the internet there must be a connection to the internet that allows mcsSprinklers to access the reporting sites. This means an always-on internet connection must be available and any firewall must allow mcsSprinklers to pass data. The reporting sites selected for Current Weather and Forecast are also expected to update their information on a regular basis. Should any barrier to successful updates occur for one hour of Current Weather or two hours of Forecast then mcsSprinklers will provide notification. In a Homeseer environment status will be provided by changing the status of the Last Weather or Last Forecast status devices. In the Standalone environment it will popup a message from its tray icon. When this situation occurs it may be useful to observe the contents of the files starting with “~” in the C:\Program Files\mcsSprinklers\Data\mcsSprinklers or C:\Program Files\Homeseer 2\Data\mcsSprinklers folders on the computer. These will contains the last downloaded data from the internet sites.

When internet weather data becomes stale then mcsSprinklers reverts to using historical ET values for the calculated control strategy. When only the AWS or WeatherUnderground data becomes stale then mcsSprinklers will use the current temperature, humidity, and wind speed from the forecast site. The loss of internet data will only affect the calculated control strategy and the status showing in the General Status page.

8.2.2 Local Sensor Data

Weather data will be used for the primary sensors unless an alternate is provided. In a Homeseer configuration the alternate is identified by virtual device code. Any non-blank device code will become the source of the sensor rather than from the weather data report. The Homeseer Device String is expected to contain the data. HTML tags can exist in the Device String content and these will be removed by mcsSprinklers.

xAPBSC.Event or xAPBSC.Info schema messages can be used when not in a Homeseer configuration. The Target address will be blank or resolve to mcsSprinklers address for it to be accepted. The sensor value can be contained in either the Text or the Level key of the BSC message.

The Weatherhawk weather station is interfaced using the LAN and a HTTP protocol supported by the Weatherhawk. This is done via the IP addresses setup for the Weatherhawk.

Other weather instruments are typically interfaced using the computer's file system and a text file. The software interfacing the weather instrument will produce a comma-separated-values text file with the current conditions reported by the instrument. mcsSprinklers will periodically read the first line of this text file and extract the data in the column specified in the Setup8-Weather for CSV input. Column 1 is the first column number. Data will be time-stamped by mcsSprinklers when it is input. Any timestamp produced to the weather instrument interface software is ignored. Multiple lines are also ignored so it is not possible to import historical data into the mcsSprinklers database, but can only input current conditions.

The preferred method to accept csv data is with a one line file. It is also possible to accept a larger file and use the last line of the file. Provisions exists to process multiple lines to sum data over an hourly interval should it be necessary. The options for these capability will be provided when the sensor is selected to have a csv source.

The csv file can be local to the computer, the LAN or retrieved via http or ftp protocol for a remote location. If the start of the file name is http: or ftp: then it will be retrieved via IP interface. If running on a Linux system then the file path can be relative to the root of the data drive and this is indicated by not using a slash at the start of the path. For all other Windows and Linux cases the file name should be the full path.

8.2.3 Inhibit Device

A user-controllable inhibit device is available as a Homeseer virtual device or as a xAPBSC.Event/xAPBSC.Info message. The Homeseer Device Status is used with values that resolve to ON (2) to cause the inhibit restriction condition to occur. The xAP BSC message State key is used with a value of ON to activate the inhibit condition. If the inhibit via xAP is connected to something like a rain sensor then some form of periodic messages are recommended to assure that mcsSprinklers will be aware of the unit's status.

8.2.4 ET Radiation Sensor

The primary contributor to the ET calculation is solar radiation. If the ET sensor is specified then it will be used. The expected ET sensor value is the daily ET which will increase throughout the day and then reset to 0 at midnight.

If both a Temperature Sensor and Solar Sensor are identified then the solar radiation will be based upon these. The Solar sensor in this context is the "in the sun" temperature while the Temperature Sensor is the "in the shade" temperature.

8.2.5 Water Meter

The water meter is associated with a pump within an Area. The water meter sensor can still be used when no pump device is indicated. If a single meter exists for the site then this same meter address should be used for each Area so the water use for all zones will be measured.

The water meter input is expected to measure the daily water use in terms of gallons or liters. It can also measure the running total that does not reset at midnight.

8.3 Alternate Control Operations

8.3.1 Homeseer

Homeseer presents a virtual device interface that is user-controllable and this interface can be used via the Homeseer user interface or scripting. Any control that is available on the mcsSprinklers General Status page will be available for control via Homeseer. Any status on this same page will be available to Homeseer as a Device Status or Device String depending upon the control and context. The Device Value will also be populated with the numeric value of the device scaled by 100.

The scripting interface for a Homeseer user is via the plug-in object. The object of interest for the Professional level is hs.GetPluginEx("mcsSprinklersP") when iterating or hs.Plugin("mcsSprinklersP") otherwise. mcsSprinklersS or mcsSprinklersB is used for other levels. For standalone the object is CreateObject("hspi_mcsSprinklers.hspi"). Manual control of valves can also be done via their device code per the rules of the remote setup.

A typical use to determine number of minutes remaining on the current program schedule where the device S53 is the site status device.

```
Set mcs = CreateObject("hspi_mcsSprinklers.hspi")
sMinutesToGo = mcs.RemainingMinutes("S53")
```

The interface method prototypes are listed below.

```
Public Sub ForceNewDay()
          'reset all internal state information to a start of new day
          state

Public Property Get NextSprinklerZone(jArea As Integer) As String
          'Find the next zone in each area to be watered today
          'Return the next one independent of zone if jArea = 0
          'Otherwise return the next one

Public Property Get CurrentSprinklerZone(iArea As Integer) As String
          'Return the currently active zone of an area

Public Property Get PreviousSprinklerZone(iArea As Integer) As String
          'Return the previously active zone of an area
          'If Area input = 0 then find the most recently changed valve
          overall

Public Sub SetManualControl(sDC As Variant, iDuration As Variant)
          'set manual control duration of selected device

Public Function ScheduledMinutes(sDC As String) As Long
          ‘Return number of run minutes for auto program of selected
          zone
          'Selected device can be valve or area or site status devices

Public Function RemainingMinutes(sDC As String) As Long
          'Return number of run minutes remaining for selected zone
          that is active
          'Selected device can be valve or area or site status devices
          'Return 0 if not active
```

```
Public Function RemainingMinutes(bNoHTML as Boolean) As String
          'Return number of minutes remaining in currently running zone
          'or time when next zone is projected to start
          'Can be formatted with Icons in HTML based upon bNoHTML
           'Also includes the device code and zone name

Public Function OverallStatus (bStripHTML As Boolean) As String
            ‘Return a descriptive string for overall site status
            ‘This is intended to be available for other display devices

Public Function LoadSettings(sFile As String) As Boolean
            ‘Return true if load was successful
            ‘Used to command a configuration change from a file in the
            \Config\Alternate folder
```

8.3.2 xAPBSC.Cmd

xAPBSC.Cmd schema can be used to control any button that is available on the General Status page. The UID’s for this control can be observed on the xAP Reporting page from a Browser. The subaddress or ID can be wildcarded per xAP rules if desired.

Only devices that have been checkboxed on the xAP Reporting page will be processed. The same is true when using xAPBSC.Query to obtain current status from mcsSprinklers. Only devices that have been explicitly selected will respond to the Query.

xAPBSC can also be used to control valves if the valves are checkboxed. The control, however, will only be allowed if an alias has been setup on the Remote Page for the valve.

8.3.3 xAP-X10 / Homeseer-X10

The Remote page of mcsSprinklers is used to associate relationships between an X10 valve and an X10 address that can be used manually control this valve. xAP-X10 or Homeseer X10 events are used to signal mcsSprinklers to take the desired control action. The alternate X10 address is referred to as the Alias.

If Homeseer is used to command the same X10 address as the valve then mcsSprinklers will attempt to override the control action at its next 1 minute control cycle. xAP-X10 commands received for valves that are controlled by the serial port managed by mcsSprinklers will be accepted for the Alias. Direct valve control will be ignored.

9 Redundancy and Backup

mcsSprinklers is designed with considerations for use of redundancy and automatic reversion to backup sources and control. It can be configured to operate on a single computer or cooperatively on two computers. It can accept weather and forecast data from external sources and when not received from those sources it will obtain them locally from the internet. Internet weather data can be obtained from up to three sources and when these sources are not reporting then it will use the data from the forecast.

It also provides a self-monitoring capability for backup operation on a single PC or embedded platform. In the self-monitoring case, which is enabled with checkbox entry, the system looks for the mcsSprinklers process to disappear and will then restart it. mcsSprinklers performs its scheduling based upon a midnight to midnight interval. A restart at midnight option is also provided to assure each day starts with a clean slate and any anomalies will not propagate between days.

Testing can be done on the backup and monitoring operations with use of the "Test" button in the "Redundancy Backup Mode" section. When this button is clicked then mcsSprinklers will not send its health data and the backup mechanisms will kick-in after sufficient timeout. This will typically be from 10 to 15 minutes after the "Test" button is clicked. It can be clicked again to re-enable transmission of health data.

After a setting is changed for monitoring or backup then mcsSprinklers should be restarted to assure a proper startup sequence for the backup functions. This is not necessary and should not be done when the "Test" button is used.

9.1 Single PC Configuration

In a single PC configuration a backup is achieved by monitoring the operation of mcsSprinklers. When the monitor detects incorrect operation it will restart the PC, restart mcsSprinklers or halt mcsSprinklers to allow it to be restarted by other mechanisms. This mode of operation is selected with the Redundancy Backup Mode radio button set to "Monitored" per Figure 70. For this operation to be effective a shortcut to mcsSprinklers.exe must exist in the Window's startup folder.

The monitoring is performed using xAP communication of a Role schema that is monitored by xapmcsMonitorRole.exe. xAP communications require a xAP hub to be running and this is satisfied by xapmcsHub.exe. Both of these applications are started when the Monitored mode is selected.

9.2 Dual PC Configuration

9.2.1 Control Moding

When mcsSprinklers is installed on two computers on the same LAN they can be configured to operate in either an active/standby or and active/active mode. In active/standby then the primary computer is controlling the valves and the standby computer is doing the same internal computations and observing the behavior of the primary computer. When the primary computer appears to have failed then the standby computer will then take over control of the valves. In an active/active mode then both computers are controlling the valves at the same time. There are tradeoffs between the two modes that will be discussed later. The Active/Standby (Standby Backup setting) is the recommended if dual hardware interfaces (e.g. two CM11A for power line interface) are used. Active/Active or Active/Standby is appropriate if single hardware interfaces exist.

The setup for dual PC operation is done on the Other Page in the section "Redundancy Backup Mode" as shown in Figure 70. Note that the blue color for most of these setup items. The blue indicates that the

setting needs to be made individually on each of the two computers. The blue color appears when a Standby or Active backup mode is selected.

One of the computers needs to be identified as the primary. The primary is where the non-blue configuration information is retained. This means that all the setup, excluding the small segment shown in blue in Figure 70 is stored on the primary computer and referenced by the secondary computer using the network file sharing capability. This means that the mcsSprinklers folder (e.g. C:\Program Files\mcsSprinklers) must be a shared folder on the primary computer. The setup of file sharing is dependent upon the Windows operating system version.

The path to the primary computer needs to be entered as the full network path such as is shown in Figure 70.

The Takeover user-entry is the time for the secondary computer to wait before it assumes primary control. Internally the monitoring is done on five minute intervals so any value under 10 will produce unreliable results with primary control switching often. When in Active Backup (Active/Active) mode the takeover time does not have any operational significance since both computers are always actively controlling the values. What is does affect is the time it takes for the status device 73 to report a failed redundant computer. This status is shown in Figure 71. This notification will also show up as a priority message as is shown in Figure 66.

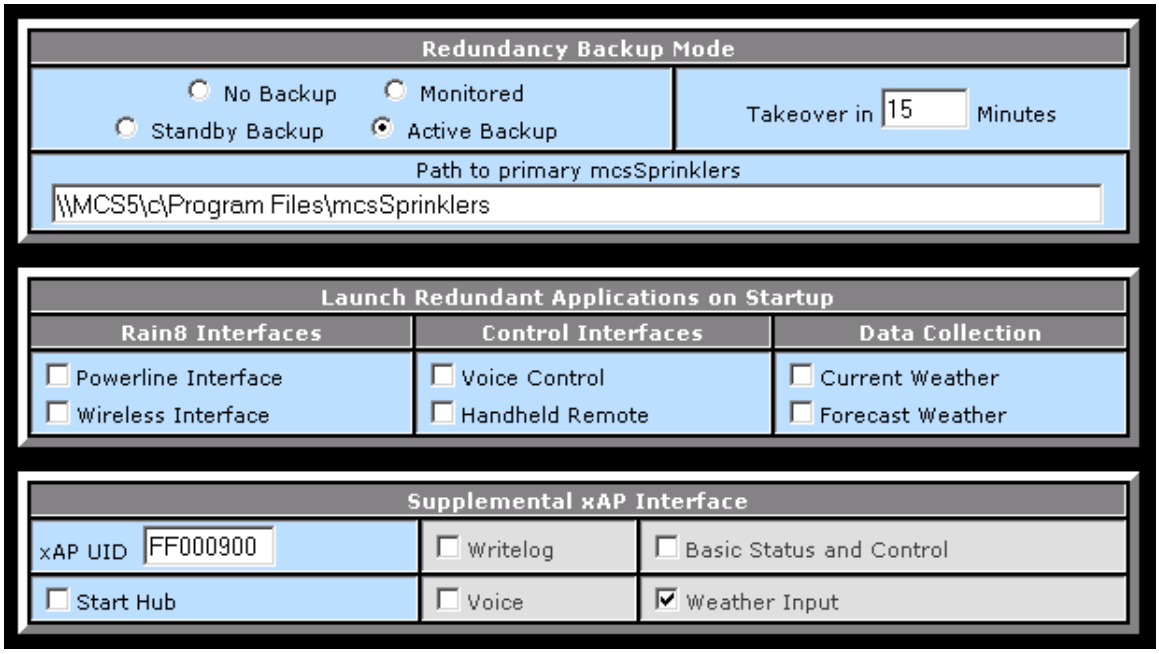


Figure 70 Dual PC Setup

Today 11:09 AM	S70	Last Forecast Received	Today 10:59:29 AM	
Today 11:36 AM	S71	Last Weather Received	Today 10:53:19 AM	
irrigation active	S72	Self Redundancy Mode	Today 11:08:30 AM	
irrigation active	S73	Other Redundancy Mode	Today 10:53:19 AM	
Auto	S74	Auto-Manual Mode	Today 10:48:08 AM	
	S75	Skip Tomorrow	Today 10:48:06 AM	OFF ON
	S76	Manual Stop	Today 10:48:06 AM	OFF ON
	S77	Manual Override	Today 10:48:06 AM	
	S78	Seasonal Control	Today 10:48:06 AM	

Figure 71 Redundancy and Moding Status Devices

9.2.2 Independent Applications to Support Redundancy

mcsSprinklers contains interface drivers for the power line CM11A, RF output CM17A, RF input W800, Voice, and internet for forecast and weather. All of these interfaces are also available as independent applications that are interfaced to mcsSprinklers via the LAN using a xAP message protocol.

With the use of external interfaces then additional levels of redundancy and backup exist. For example, assume the X10 power line interface is setup on the Rain8 page to use xAP as the interface rather than an internal communication port. This then allows the Power line Interface application to be run independently and this same application can be used by both the primary and secondary computer. This works well in an active/active configuration to avoid potential X10 power line collisions that reduce the reliability.

It is also possible to run these impendent interfaces on a third computer or to run them on multiple computers which each computer having the redundant interfacing hardware. The way the system is configured is determined by the failure modes that one is trying to overcome.

When running in active/active mode then it is important that both computers see the same inputs. This included internet data and manual control inputs. If a W800 is used to accept handheld remote control inputs from a palm pad then this same input should be seen by both computers. To support this configuration there should be one W800 that is interfaced as an indecent application. This application can be run on any computer, and can be launched automatically by mcsSprinklers if it is on the same computer as mcsSprinklers. This is the checkbox entry for “Handheld Remote”.

The same rationale applies for the Forecast and Weather internet data. If the internet data is available from the independent application then mcsSprinklers will use it. If two mcsSprinklers computers are running, then both will see the data at the same time. If these independent applications are not run then each mcsSprinklers will recognize the data is not being received and will go to the internet to obtain the data. The two computers may or may not be scheduling in the same manner depending upon the success of the internet connection.

Status devices 72 and 73 show the current redundancy mode. These can be viewed in Figure 71. Device 72 reflects the computer on which the page is being viewed and device 73 reflects the reported status from the other computer. When the other computer fails to report in the user-specified takeover time then the status of device 73 will show a failed condition. Other than the failure condition a status of “irrigation standby” may also be observed when configured for active/standby operations.

9.2.3 Associated xAP Interface

The xAP LAN protocol imposes some needs on the configuration when redundancy is applied. When xAP is used then one xAP hub must be running on each involved computer. If one does not already exists then it can be launched by mcsSprinklers by checking the Start Hub checkbox.

Furthermore each applications that uses xAP as a communication mechanism needs to have a unique identifier. The default for mcsSprinklers is FF000800. The default for the secondary mcsSprinklers is FF000900. These can be changed as necessary to assure that each application has a unique identifier.

9.3 Multiple Rain8Net Networks

When using the power line to provide distribution of commands to the Rain8X10 or the Rain8UPB there is usually no need to have more than a single power line interface for mcsSprinklers to manage. In the case of a large wired network using the Rain8Net then situations may arise where more than a single Rain8Net or Rain8 WiFi master will be put into service. This is especially true if the Rain8Net is in the Rain8 WiFi configuration were multiple WiFi IP addresses are being employed.

The multiple network configurations are supported by one of two methods. One is with multiple ports on the host PC and the other is with distributed interfaces using the LAN and xAP. When using multiple ports on the host PC then the setup is simply the identification of the number of masters and the port for each master on the Rain8 setup page. The only special consideration is that each Rain8 modules must have a unique modules address event though it is interfaced to different ports.

The multiple network configurations using the xAP interface within mcsSprinklers is supported with an instance of xapmcsRain8Net for each Rain8Master or WiFi IP address. Each instance of xapmcsRain8Net can run on the same computer as mcsSprinklers or they can be run on different computers within the same LAN. When run on the same computer then each instance will have its own folder from which to execute. To create the folder structure for xapmcsRain8Net then a new folder should be created and xapmcsRain8Net copied to that folder. An HTML folder should also be created within this new folder. The files, excluding subfolders, from the mcsSprinklers\HTML folder should be copied to the new HTML folder. This is repeated for as many instances as needed.

To automate the startup process a shortcut can be added to the Windows startup folder for each instance of xapmcsRain8Net. There will also be a shortcut to mcsSprinklers so that all software components will start at the same time. One instance of xapmcsHub must also be run on each computer on which either xapmcsRain8Net or mcsSprinklers is run. A shortcut to this in the startup folder is also appropriate.

Once the folder structure is setup then each instance of xapmcsRain8Net is configured to give each its unique identification and define the Rain8Net modules that it will interface. When first run an icon like will appear in the tray. The setup can be accessed by clicking on the icon and selecting Browser. to bring up the page shown in Figure 72

A unique HTTP Server Port, xAP Identification, and Serial connection are needed for each instance. The default server port is 8016 so it is best to change the HTTP port for all but the last one configured so remote administration can be achieved with multiple instances running.

The Serial connectivity is the same type of setup as with mcsSprinklers where either an IP address and port or just a local serial port can be selected.

The xAP UID should be unique, but the first two characters must be FF and the last two 00. The instance number can be any alphanumeric text. The text entered will also appear in the tray icon the next time xapmcsRain8Net is started.

The tray icon can be hidden or left showing in the tray. Remote administration can be gained from a browser with the URL set to the computer network id followed by the server port and /status. (e.g. http://mycomputer:8016/status)

After the Rain8Net modules to be interfaced are connected then the "Find Rain8 Modules" button can be clicked in the same manner that was described for mcsSprinklers or the module numbers can be entered into the text box for the Rain8 Net module setup.

After the "Save Changes" button is clicked then a listing of the valves for all modules entered will show at the top of the page. Each valve that will be used should be indicated with a checkbox in the "Used" column. A name in Location column can also be entered to help identify it. It can be the same name entered on the Wiring page of mcsSprinklers, but need not be.

ON and OFF buttons will appear for any valve that is indicated as being used. These will provide local control of the valves independent of mcsSprinklers. They are primarily a diagnostic aide since control will normally be done via mcsSprinklers.

The "Send All-Off Command" button will command all the valves to the OFF state. The "Query Rain8Net Modules" button will refresh the status from the modules.

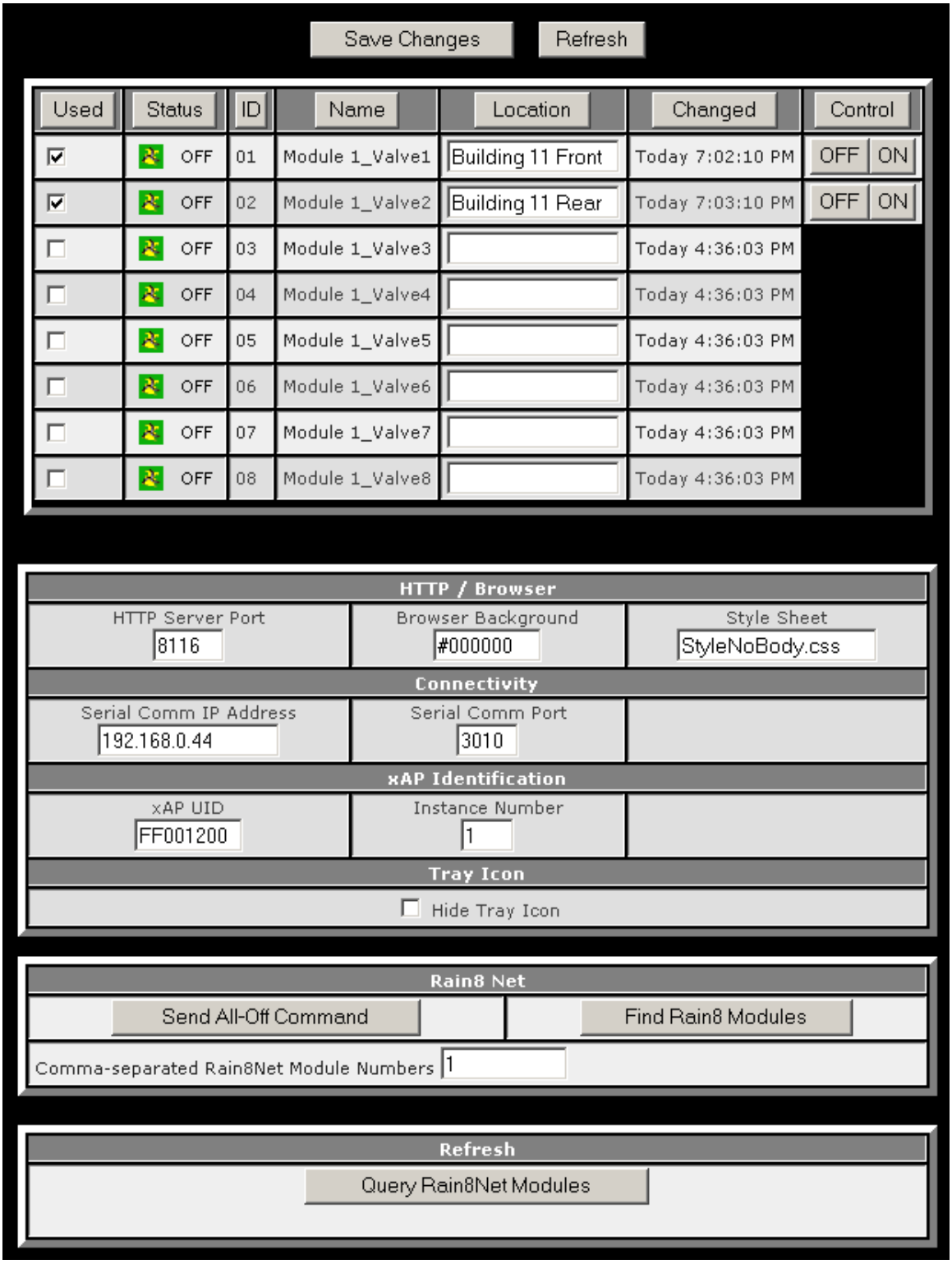


Figure 72 xapmcsRain8Net Setup

The tray icon also provides an I/O window popup that can also be used for diagnostics to observe the raw communications with the Rain8Net modules. This is similar to the Rain8/W800 I/O popup of mcsSprinklers.

After each instance of xapmcsRain8Net is configured then it can be put into service with mcsSprinklers. The two setup items in mcsSprinklers necessary to integrate into this configuration that are contained on the Rain8 Page of mcsSprinklers and shown in Figure 73 and Figure 74. The Rain8-Net interface is selected to be External via XAP Address with a text box entry of "mcs.Rain8Net.>". The modules are identified by entering their module number in the text box of Figure 74. The "Find Rain8 Modules" will not be effective since the modules are not locally connected to mcsSprinklers internal port.

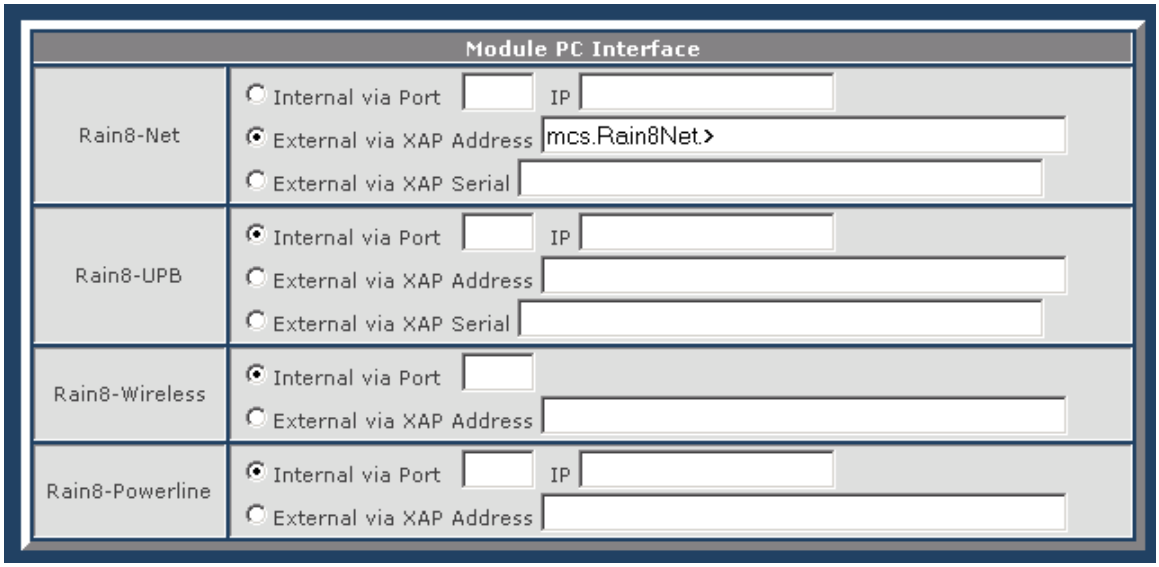


Figure 73 Rain8Net Configured for Multiple Masters/IPs

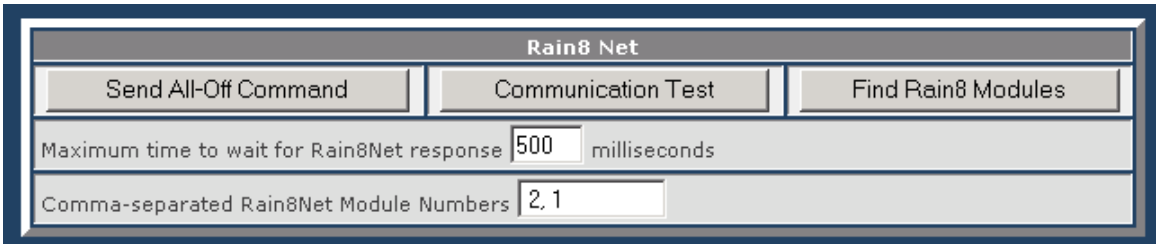


Figure 74 Rain8 Net Manual Entry of Module Numbers

When mcsSprinklers commands a valve of a module that is interfaced through xapmcsRain8Net it will send a message over the LAN. The module that recognizes the command will act upon it and provide a status response when the valve hardware indicates the desired position has been achieved.

If a status response is not received by mcsSprinklers within 15 seconds then it will reissue the command up to two additional times. Three no responses or the unexpected response will cause mcsSprinklers to show the valve as failed on its status display. This is the same behavior as if the valve was connected internally by mcsSprinklers.

9.4 Configuration Backup and Selection

mcsSprinklers maintains configuration setup information for the currently active setup is retained in the file …\Config\mcsSprinklers.ini. Each time a configuration change is made it saves a backup copy of the prior configuration in the same location with a numeric suffix added to the filename. Up to 10 backups are saved in this manner. Restoration of one of these backups can be performed from the Other page, Configuration Administration section, Restore Configuration from Auto Backup selection as shown in Figure 75. The date of each of these backups will be shown in reverse chronological order.

It is also possible to develop more than one configuration, save the configuration, and then restore it. For example, there may be a springtime configuration, a summer one, and a third used to winterize the system. After all the settings are made as desired for a specific configuration then it is saved by giving it a simple name (i.e. not a file path or file name) and clicking the Save button from the Configuration Administration section. The configuration can be restored using the Load Configuration pull down from the same area.

The configurations can be manually loaded at any time or they can be scheduled for any day of the year to be loaded at midnight. The automatic scheduling could be used for situations where seasonal adjustments are necessary that go beyond the normal range of parameters provided by mcsSprinklers. To use the automatic scheduling of configuration changes there will need to be a set of configurations saved. Access to schedule these is from the calendar icon shown in Figure 75. Use of this icon will bring up the annual calendar. Clicking any cell in the calendar will make a second popup visible where the scheduled configuration file can be observed, changed or a new one entered. See Figure 76.

It is also possible to "undo" the last Load Configuration selection by selecting the "Restore to Before Last Loaded Configuration" button. When this is done the configuration that was active immediately before the Load Configuration operation will be restored.

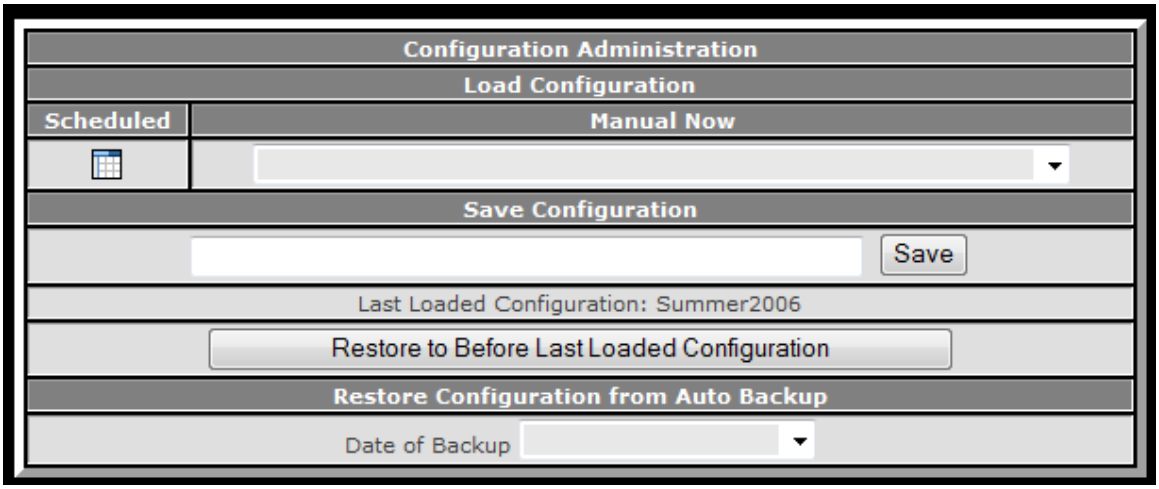


Figure 75 Configuration Save and Restore

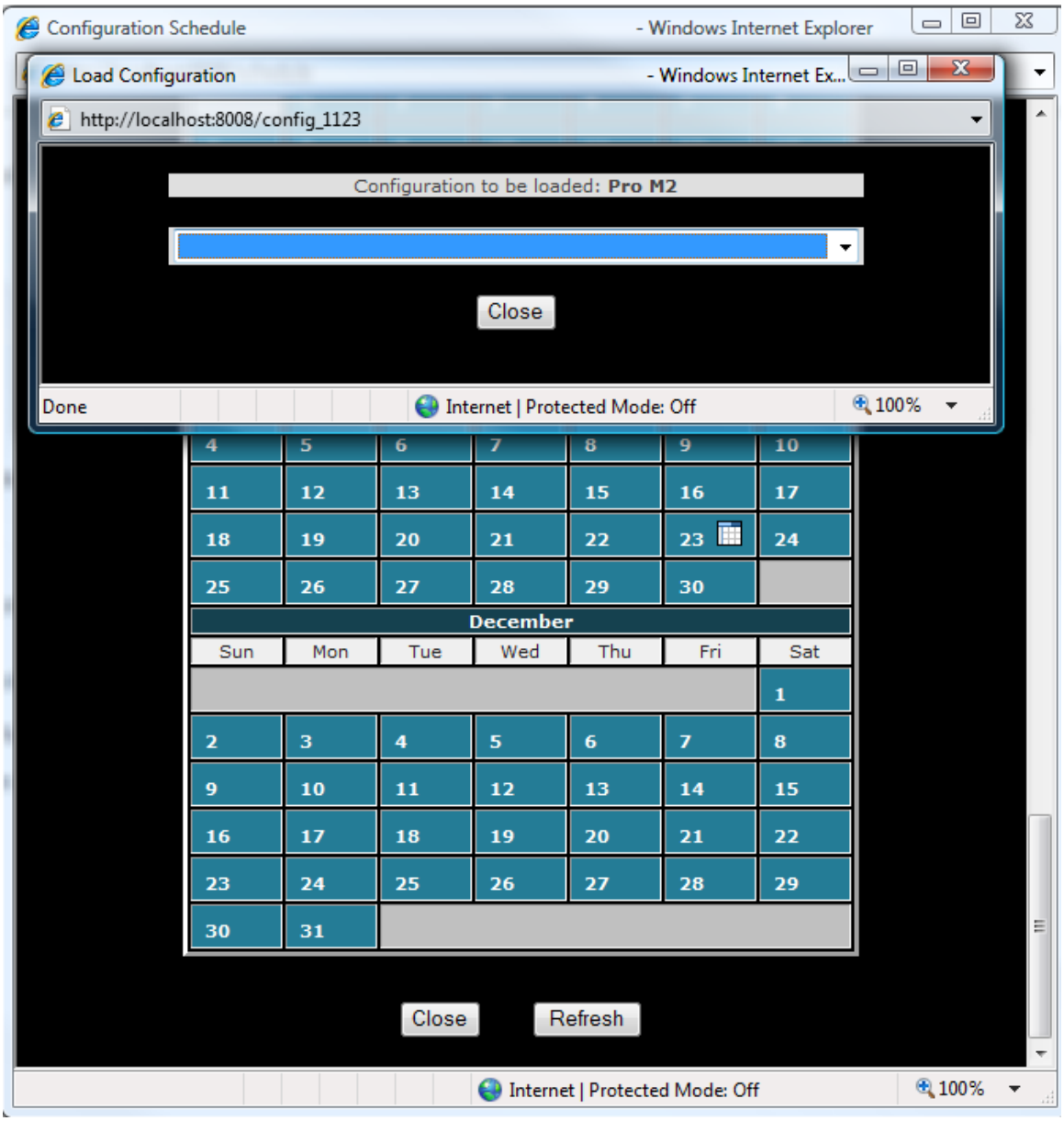


Figure 76 Automatic Configuration Load Scheduling

10 Setup Reference

10.1 Setup1-Rain8

10.1.1 Module PC Interface

The interface to the Rain8 modules can be either directly connected to a COM port on this PC or available on any PC that is on the same network. The radio button selection determines the interface location for each type of Rain8 Module and the box is used to enter the COM number or the Xap address.

The Xap address can be wild carded such as *.CM11A.* to indicate that any CM11A xAP node should respond to a command. An explicit target, such as mcs.CM11A.MyPC can also be used to specify as particular node on the network that is responsible for the power line interface with the CM11A.

The Xap Serial is used when the serial port is connected via xAP protocol using the xAPBSC schema. The Netiom is one device that supports this type of connection.

The Homeseer interface applies to the mcsSprinklers as a Homeseer plug-in and the interface is achieved using the ExecX10 Homeseer scripting method.

It is generally the case that internal COM ports are dedicated to a specific application and the same port cannot be used amongst applications. In the case of the Power line and Wireless interfaces they can share the same port if desired.

10.1.2 Interface Test

When the RF button is pressed then an ON, 5-second delay, and then OFF is sent to device address A1. The same is done when the Power line button is clicked except the commands are delivered on the selected power line interface.

These buttons are intended to provide a means to test the connectivity of the Rain8 modules to the PC.

10.1.3 Homeseer X10-IO Devices

Devices that are to be controlled by the Homeseer generic X10 or IO interfaces are itemized in this list. Commas are used to separate device codes. For example] 3,]45,A5,B15.

10.1.4 Rain8 Net and Rain8 WiFi Master Modules

A typical Rain8Net or Rain8Wifi configuration will have one port on the PC with one or more Rain8 modules daisy-chained. It is also possible to use multiple ports on the PC with each connected to one or more Rain8 modules. This second configuration is most appropriate with the modules need to be physically separated.

The communication protocol is also specified in this section for how mcsSprinklers obtains valve status from each Rain8Net module. Each command sent to the Rain8Net is always confirmed and retried when necessary. Valve status is optional and can be after each command or every minute. If communications interface is robust then the polling every minute will assure proper synchronization between the hardware and software. If the interface does not maintain timing between commands very well then unexpected mcsSprinklers recovery actions can be observed.

10.1.5 Rain8 Net and Rain8 WiFi

The All-off button will turn all valves connected to the Rain8-Net off. The Find Modules button will scan the Rain8-Net for all modules connected. A new window will show the current address being searched. At any time the search can be aborted by clicking the same button that now has an Abort label. Rather than searching it is likely easier to just enter the module IDs using a comma to separate each if more than one module is being used.

When communicating with the Rain8Net there will be some delay before a response is received. The value selected is the threshold before a retry is attempted and then eventually a failure declared. If the Rain8Net is connected via an IP/Serial device and communications are via IP then a reset of the IP/Serial device can be specified when there is an inability to establish a connection to the device. To use this capability the IP/Serial device needs to be plugged into a device to which power can be controlled. The control can be via X10, UPB, xAP xAPBSC schema or Homeseer device code. The address or device code is entered into the reset device field and the delay field will contain the time it takes for the IP/Serial device to power up and complete its initialization.

10.1.6 Rain8 UPB

The All-off button will turn all valves connected to the Rain8-UPB off. The Module number box identifies the Rain8UPB modules that are connected. The module ID's are defined when the EPROM is programmed. They will be 1, 2, etc and correspond to UPB DIDs 1 through 8, 9 through 16, etc. The Network ID text box is used to enter the UPB NID.

10.1.7 Rain8 Wireless and X10 Power line Interface Module Assignments

Rain8 Wireless and Power line modules are organized into lower bank and upper bank configuration where the lower bank is associated with unit addresses 1 to 8 and the upper bank with addresses 9 to 16. Each unit is also associated with a house code. The map of the type of interface vs. the house and bank is made by selecting the type of module radio button at the intersection of the House row and Bank column.

10.1.8 House

This is the identification of the house code for the module.

10.1.9 Bank 1 to 8

Select the radio button that identifies how a Rain8 module has been programmed. It is the intersection of the selected house code and lower bank.

10.1.10 Bank 9 to 16

Select the radio button that identifies how a Rain8 module has been programmed. It is the intersection of the selected house code and upper bank.

10.1.11 Rain8 Wireless Valve 8 Configuration

Rain8 Wireless can be configured to allow value number 8 of the module to be slaved to the other 7 valves or to operate independently. When independent, the module will control 8 valves. When slaved it will control 7 valves plus a pump.

10.1.12 Address

Address of Valve 8 of the module

10.1.13 Valve 8 in Module

Radio button is used to identify how the module has been programmed. When independent is selected then the module supports 8 valves. When slaved, the last valve will be on when any other valve is on and off when all other 7 valves are off.

10.1.14 EtherRain Modules

EtherRain modules are identified by IP address and port. All modules are assumed to have the same username and password setup during configuration with the Quicksmart admin utility. Once the number of modules are selected then rows will be available to enter the IP address and port for each module.

10.1.15 Rain8 EPROM and Timers

All Rain8 modules need to be programmed to identify as a minimum the address to which it will respond. Programming is done one module at a time with a direct connection to the PC and without any transformer or valves connected to the Rain8.

The programming of each Rain8 unit, independent of model, is done off-line via the Communication port identified in the programming port text box. The same port that is used for Rain8 Wireless or Rain8 Net can be used here, but the others will be disconnected when programming of the timers is started.

There are differences in the programming of the Timer EEPROMS so the type of unit needs to be identified. This is done with the three-option radio button in the Module Type group.

When reading the EEPROM, via the “Read Timeout Timers” button the House/Bank or Net address fields are populated based upon the contents of the EEPROM that was read.

When programming the units the address or House/ Bank code entries need to be entered before the “Download” button is clicked. In the case of the Power line and Wireless versions a House code and upper/lower bank specification needs to be entered before downloading timer values. Note that when the download does occur the House code will be programmed into the unit as well. For the Rain8 Net the address in the range 1 to 255 is entered into the provided text box.

The right part of the Timers group contains a row for each Rain8 valve. The text boxes are used to enter the timeout values to be programmed into the EEPROM. They are in decimal minutes and different units have a different range of values that are valid.

The Download and Read button can be used at any time the unit it connected to the Programming Port to either download or confirm the contents. Note that the Communication port provides the power to the Rain8 when it is being programmed so no connection to the 24VAC transformer is needed during programming.

10.1.16 Programming Port

The COM port number is entered into the box. This is the port to which a Rain8 module is connected to allow its memory to be read and changed.

10.1.17 Module Type

Identify the type of Rain8 module that is connected to the programming port. The section is made with the radio buttons.

10.1.18 Module Address

The Rain8-Net uses a numeric address in range 1 to 255. The other units use an alphabetic house code in the range A to P plus and identification of the bank. The selection made for the Wireless and Power line modules will have a corresponding entry in the above table when the unit is deployed.

10.1.19 Rain8-Net Timer Disable

All Rain8 models can use timers as a safety measure. With only the Rain8-Net can these timers be disabled to allow a valve to remain on for an indefinite time. The checkbox is used to make this selection for the Rain8-Net model.

10.1.20 Rain8-Wireless Valve 8 Use

The Rain8 Wireless model can be configured as 7-independent and 1-slave or 8 independent valves. When configured in the 7/1 mode then the slave valve will be ON when any of the other 7 is ON and OFF when all the other 7 are OFF.

10.1.21 Rain8-X10-2 Status Response

The Rain8 2 Way can deliver a status response following each command or it can deliver this response only when requested using an X10 Status Request command. In a shared environment where the X10 interface is not managed by mcsSprinklers then the unit should be configured for poll status response only. In this case it will operate much like a 1-Way Rain8 X10 with the ability to poll. When managed directly by mcsSprinklers then the immediate status response is used to update the actual valve status only when an acknowledge is received rather than update upon command sent.

10.1.22 Rain8 Timers

Timer values for each valve are entered in the text box. Maximum values are 250 minutes. Minimum values are 1 minute. A value must be specified except in the case for the Rain8-Net module when the timers are disabled.
Direct control of the Rain 8 series of irrigation controllers is provided via mcsSprinklers. The setup of the Rain8 is done on the “Rain8” Tab.

All Rain8 devices can be programmed with a timeout for a zone. When programming the timeout, a single Rain8 unit is connected to the Communication port for programming. Programming cannot be done in a multiple configuration or via mechanisms other than a direct connection to a serial port.

10.2 Setup2 - Wiring

10.2.1 Wire Harness

A wire harness represents a bundle of wire routed between the valve head and the Rain8 module. Any of the wires in the hardness that are used will be assigned to a control valve. A harness can be given a name to assist with later identification. This name is not use later in the setup

10.2.2 Wire Color

Wire colors in the standard wire harness are listed. If physical wire colors are different then the color codes relationships will need to be maintained externally.

10.2.3 Control Valve

The pull down contains all the Rain8 modules that were identified on the Rain8 Setup. The particular valve to which the wire is connected is selected with the pull down. Care should be taken so he same value is not assigned to two wires.

10.2.4 Location

The location box is used to identify the valve with a friendly name. This name will be displayed on status pages and will be the name used in voice control.

10.3 Setup3 - Layout

The layout page allows the valves that are defined in the wiring setup to be assigned to Areas or used for pump or fertigation control. When the valve is assigned to an Area, then its run time can be entered for the auto programs, manual operation or syringing. The layout page is shown in Figure 19.

Three columns of information are shown for each valve defined in the system. The column title button can be used to sort the valves by physical name, assignment or auto program time. The defined valves will be shown in a row with a light or medium gray background. The undefined valves will be listed in a blue background.

10.3.1 Picture

The Picture column shows the information that was entered on the Wiring Page that identifies a valve. If a picture is available it will be shown. The textual description under the picture contains the physical valve identification and the zone name associated with this valve.

10.3.2 Assigned Use

Each defined valve can be assigned to an Area, used to control a pump or fertigation valve, or left unassigned. The radio buttons in the matrix are used to identify the assignment. When used for pump or fertigation then the same valve can be assigned to multiple areas. The example in Figure 19 shows how the 8th valve of a Rain8Net module is assigned as the pump for Areas 1, 2 and 3. The zone valves that are assigned to an area can only be assigned to a single area. The first four valves are assigned as zones individually in Areas 1, 2 and 3.

The assignments made here will also be reflected in other setup pages. Zone assignments will be seen on the Zone Setup and Area Setup pages. The Pump and Fertigation assignments will also be visible on the Area setup page.

10.3.3 Minutes

Three base irrigation times based upon the irrigation mode are shown in the Minutes column. The Auto time is the number of minutes that the valve will be turned on for the first time that a valve is activated on a day that the Area control strategy enables the valve. If there are multiple times used during the day for the same valve then a clock icon will show to the left the Auto entry. Another popup page such as is shown in Figure 21 will be shown if the clock icon is clicked. This page will allow other times to be viewed and changed. Other views of the daily program can be seen on the Timed Programs Page and the Area Page.

The Manual time is the maximum number of minutes that a valve will be allowed to run when the zone is manually enabled. A valve is manually enabled from a variety of locations including the Zone Status, General Status or remote mechanisms.

The Syringing time is the number of minutes that a valve will be activated when the syringing stress conditions have been satisfied. The syringing conditions are setup on the Site Page.

The values for the duration of three modes can also be setup on the Zone Setup Page. The Zone Setup Page will also allow for additional information that zone operations.

10.4 Setup4 - Zone

The valves identified in this area group will be controlled by the control strategy of the associated area. This control strategy is defined in the Area Setup Page. Up to twelve zones can be grouped into an area. When an area is scheduled for watering then each zone, in the order entered, will be sequentially watered.

10.4.1 Valve

The control valve for the zone is entered with the pull down. Selections available are those that have been defined in the Rain8 Setup and Wiring Setup pages.

10.4.2 Auto Minutes

The number of minutes of watering for the selected valve is entered in the text box. This will be the number of minutes the valve will remain ON when an automatic watering cycle occurs. Integer values are used to indicate minutes. If durations with resolution to approximately one second is desired then the value is entered in the format mm:ss.

10.4.3 Manual Minutes

The number of minutes of watering for the selected valve is entered in the text box. This will be the number of minutes the valve will remain ON when a manual control via the Web page, Voice, or RF Remote is actioned. Integer values are used to indicate minutes. If durations with resolution to approximately one second is desired then the value is entered in the format mm:ss.

10.4.4 Syringing Minutes

The number of minutes of watering for the selected value for the mid-day syringing cycle. This is typically under five minutes and is activated based upon the Syringing control on the Other Setup page. Integer values are used to indicate minutes. If durations with resolution to approximately one second is desired then the value is entered in the format mm:ss.

10.4.5 Soil Efficiency and Rain Factors

The Soil Efficiency and Rain Factor entries allow tweaking of the soil moisture content algorithm. Soil Efficiency relates to the ability of the soil to retain water with is a result of a combination of soil type and crop type. Higher values indicate that the soil will tend to retain moisture or the crop is efficient in holding moisture and does not allow moisture loss through its structure. A nominal value is 0.75. The Rain Factor relates to the degree that rainfall is allowed to reach the zone. A nominal value is 1.0 and a value of 0 indicates that the zone is covered and rainfall will not reach the soil level.

10.4.6 Fertigation Factor

The fraction of time (from 0.0 to 1.0) to be applied to the zone's Auto Minutes for control of the fertigation valve that is identified on the Area setup page. The fertigation valve is slaved to the zone valve when turned ON and the turn OFF will be determined by the factor.

10.4.7 Calc Flow

The entry is used to estimate water consumption when a metered source is not available. The number entered represents the gallons per minute or liters per minute of water use when the value is ON

10.4.8 Max Flow

The max flow value is used in conjunction with a water meter. When the meter measurement for the zone exceeds the max flow value then a notification will be provided.

10.5 Setup5 – Area

10.5.1 Zones in Area

This section is for information only to show which zone have been defined for the specific area. The information about the zone includes the Harness ID, Wire Color, Value ID, Zone Name, and in the Homeseer case, the device code. For each zone two pieces of historical information is shown. The 30 day rate is the rate at which a watering cycle occurs. In non-timed modes this will be the soil moisture loss rate. Bar chart that shows the calculated percentage of moisture in the soil for a zone over the past seven days. This may be useful trend view to help adjust factors on the Zone and Area pages that characterize a zone's soil moisture.

10.5.2 Area Control Strategy

One of five control strategies needs to be selected. The first three are variations of watering at fixed times. The last two schedule watering based upon sensor information. In the case of the interval method a starting day value can be entered that will allow different areas to be done using the interval methods, but occur on different phases of the interval.

To support the Measured method there are three types of information that are entered to characterize the desired operation. The soil sensor scale are three values that represent the 100%, 0% and the level at which an irrigation cycle will be started. The sensor that will be providing the soil moisture readings can be from a xAP or Homeseer virtual device source. This is selected with a radio button followed by entry of the source address. There is usually a delay between when irrigation occurs and when the moisture sensor registers the increase in moisture. A fixed delay is specified to prevent a second irrigation cycle from starting before the sensor registers the increased moisture. When the Calculated method is used then the sensor information will be collected from local sensors or the Internet based upon the weather station selected on the Other Setup page. The threshold entry in the box is the calculated ET value based upon these sensors at which an irrigation cycle will start.

10.5.3 Area Zone Sequence Control

Three sequence options are available. The first runs all zones of the site in sequence with the number on the same time selectable by site. The second treats each area's zones independently with a maximum number of zones on at the same time selected by area. The last allows user to externally control sequencing while restrictions and pump control continue to be managed by mcsSprinklers.

In a setup where a single limited-pressure water source is available the selection will be normally to be make zones part of a single master sequence. If each area has a pump or the single source capacity can support multiple zones at the same time then the Zones in area sequence will be the normal selection. The Zones in area parallel selection is most appropriate for water features such as fountains where these features will all be started at the same time.

In a setup were adequate water pressure and flow rates are available then zones can be scheduled to run simultaneously to utilize the available flow. This can be done by identifying the number of zones that can be running at the same time or by the flow rate that can be supported. In the second case the zone by zone flow rates from the Zone Setup Page are used to support the scheduling.

10.5.4 Interzone Scheduling Delays

A zone will normally be allowed to run for the auto duration specified. This total duration can be split into equal time segments so the zones in the area are watered in a round-robin fashion until the total duration has been done. The number of round-robin cycles is a text box entry. A delay between each round-robin cycle can also be added to assure that adequate time for water absorption exists between each cycle.

A fixed delay between each zone can also be added to account for other factors that dictate that irrigation is spaced over time rather than continuous.

10.5.5 Area Water Supply

This setup is used when control or monitoring of the water source is needed. When no entries are made then the assumption is that the water supply is always available.

10.5.6 Pump Control Valve

The pull down is used to identify the Rain8 valve that is to control the water source. If the water supply is enabled when the Rain8 valve is turned ON then the Enable=on selection is made. If the polarity is reversed then the other radio button selection is made.

10.5.7 Well or Water Storage Discharge and Recharge Times

If irrigation is limited by capacity of well or other holding tank then provisions can be specified as to how long an area can be continuously be running and then how long to wait for recharge.

10.5.8 Flow Volume

If a water meter is available to measure water flow when the area is active then select the source of the reading from this meter. It can be a xAP address, UPB Counter Input DID, or Homeseer device code where the Device String contains the meter reading. If the same meter is used for multiple areas then include the meter in each area.

The meter will be read when a zone is turned ON and when turned OFF to determine the consumption by that zone.

10.5.9 Water Leak Monitoring

Monitoring for excessive water use with a valve is turned on is setup by identifying the period of time in the recent past for which the average water use will be established. The second setup parameter is the percentage about this average that is needed to be considered excessive and for which notification is desired.

10.5.10 Fertigation Valve

Select valve that is used to control fertigation unit. The valve has previously been identified on the Wiring setup, but not assigned to any zone.

10.5.11 Fertigation Control

Select fixed percentage to use exactly the run time percentages setup on the Zone setup page for fertigation or variable to adjust this value based upon frequency of irrigation so more is applied as the irrigation period increases.

10.5.12 Fertigation Instrumentation Source

If the media container has a sensor to indicate low volume then the source of this sensor is entered. This will allow mcsSprinklers to provide the notification when the media needs to be refilled.

10.5.13 Area Start Times and Duration Factors

For timed control strategies watering will occur starting at midnight if no other restrictions are in force. The default start time can be changed with an entry in the Time 1 box. If more than one cycle is needed in a day then Time 2 through Time 24 boxes can be used to achieve up to 24 cycles in a day. The numbers

entered for the time can be absolute times or times relative to sunrise and sunset based upon the radio button selections. These times only apply to the three timed control strategies.

A zone will be watered for the auto duration specified for the zone. The duration can be changed so each cycle within a day can have a different duration. 24 time slots are available. A factor of 0.5 will decrease the Zone duration by 50%. A factor of 1.5 will increase it 50%.

10.5.14 Area Inhibit Times

The Area inhibit times perform the same function as the Restriction page between hours inhibit however they only apply to the zone in a specific area. For the span of time between the From and To entries no watering will occur for the area. The times are entered in the format of HH:MM or just HH if no minutes are used. The times are based on a 24 hour clock with values of 0 and 24 being equivalent. The inhibit times will prevent a zone from starting. A zone or area that is already started before the inhibit period can be allowed to complete based upon settings.

10.5.15 Area Restrictions and Carryover Considerations

Minimum days between watering will assure that an automatic watering cycle will occur no faster than the specified time. The maximum days values will assure the foliage will be watered at least as often as the specified interval. The maximum days does not override other restrictions.

Both the min and max considerations are most appropriate for the calculated ET and measured soil moisture control strategies. With timed strategies the interval between watering will be well-defined by the control strategy except in cases where restrictions may be such that watering times are skipped.

The Wind and Temperature restrictions are the same as the site restrictions for these parameters but apply only to a single area. When the weather conditions satisfy the thresholds then a zone that is currently running in the area will be stopped. A zone in the area will not be started if the weather threshold inhibits the irrigation. The Zone Status page indication will show the zone to be “Delayed” and the General Status page will show an area-specific restriction for this area.

The carryover allows a zone that was inhibited during all scheduled periods of a day to be scheduled for irrigation on the following day independent of the control strategy scheduling. If, for example, an even-odd strategy is being used and the zone did not complete on the scheduled even day, then if carryover is enabled it will be scheduled to run on the next (odd) day.

Situations can occur when rainfall causes a zone to calculate moisture levels greater than 100%. For periods of continuous rain a zone may record up to 200% soil moisture level. When the rain stops and evapotranspiration starts the moisture accounting will either go immediately to 100% or it will gradually decrease based upon the calculated moisture loss. If the soil conditions are such that 100% is truly saturation then the option to snap to 100% is the appropriate setting. If the soil conditions will actually hold more than the assumed 100% then a gradual decrease is the appropriate setting.

10.5.16 Seasonal Percentages

The values associated with each month will be multiplied by the Automatic watering times entered on the Zone Setup page and this product used as the actual watering time. It is intended to account for seasonal variation when using a timed control strategy. The control strategy is setup on the Area Setup page. 100 percent is nominal for summer. When a new zip code is entered the percentages will change to default to monthly average ET for the zip code. They can be changed and the values will be retained until the next zip code change. Seasonal percentages are not used for areas under ET calculated or measured control strategies.

10.6 Setup6 - Site

10.6.1 Watering Restrictions

Watering restrictions limit times when watering will be performed. If no restrictions are selected then the watering schedule will be based solely on the Control Strategy setup page.

10.6.2 Don't on Day of Week

For any day of the week where the checkbox is checked there will be no watering performed.

10.6.3 Don't Between Hours

Limitations on the time of day that watering can occur is specified as a pair of times using a 24 hour clock. No watering will occur between each pair of times entered. The times can be entered as just an hour or as an hour and minutes using a colon separator (e.g. 10 or 10:14). A checkbox is provided to identify if the between hours restriction applies to any zone or applies to the start time for an area. When checked then any area that has started before the inhibited times will be allowed to run to completion during the restricted times. When it is not checked then no irrigation will be allowed during the restricted times.

10.6.4 Don't Even Odd Days

Checks in either of the two checkboxes can be used if watering is not to occur on even-numbered days or odd-numbered days. This may be useful if local regulations dictate such restrictions.

10.6.5 Min Days Between Watering

Entry in this box can be made to assure that watering does not occur too often. This is typically useful to encourage plant roots to travel deeper.

10.6.6 Don't with Wind

Wind will typically disturb the watering efficiency. To avoid this situation watering can be restricted to periods without excessive wind. The threshold is entered in the first box. The period for which this average speed must be maintained is entered in the second box. Too low values in either of these boxes could result in a repeated starting and stopping of the watering valve.

10.6.7 Don't with Temperature

The average temperature over the past one hour is used as the decision criteria. When it is under the user-entered value then watering in all zones will be suspended. A blank entry is used to not employ this restriction.

10.6.8 Max Cycles per Day

Entry in this box is used to place a threshold on a watering cycle. It is appropriate for measured and calculated control modes where the watering period is determined by sensors. These sensors could fail or provide bad readings and could cause excessive watering.

10.6.9 Don't with precipitation forecast and actual

Entries in this area are used to conserve water when either rainfall is forecast or significant rain has occurred recently. A line is enabled with a checkbox. If the optional entries on each line are left blank then values of zero will be used for rainfall probability or amount of rain that has fallen.

10.6.10 Don't with Evapotranspiration

Moisture loss is calculated based upon sensor inputs. When the moisture loss is calculated to be less than some threshold then a cycle can be selected to be inhibited. A value of 0 for Days is the current day only. A value of 1 is for the max daily ET from yesterday through today.

10.6.11 Record inhibit reason in Message Log

Each minute an evaluation is performed to enable a zone. When a zone is inhibited due to a restriction then this restriction can be recorded in the message log for later reference. The message log does not persist beyond mcsSprinklers sessions.

10.6.12 Don't With Homeseer Device

Virtual device code that will inhibit watering when on.

10.6.13 Water Holding / Presssure Tank

The water tank is modeled as a full level, a low level at which irrigation should be inhibited and a rate at which the tank is being filled. If a water tank is not being used then the full level should be set to 0 to indicate the lack of such a tank.

10.6.14 Syringing Options

These settings define under what condition the syringing cycle, as defined in the Zone Setup page, is started. The cycle is run up to once per day and behaves like a manual control operation other than being started automatically.

10.6.15 Manual Mode Update Options

Time of last valve action and soil moisture content are always managed in the auto control modes. In the manual mode the time and/or soil moisture can be left unchanged or can be updated as is done in the auto mode. One may not want to update these when an auto control strategy depends upon them such as min days between watering.

10.6.16 All Zones Watering Duration Adjustments

These options provide a mechanism to change the auto program durations for all zones.

10.6.17 Seasonal Percentages

Each area can adjust the watering duration based upon the monthly calendar. These percentages can be manually changed on each area page or globally changed to either historical ETo rates or to 100%. 100% will have the effect of no duration adjustment based upon calendar.

10.6.18 All Zones Adjustment Percentage

The percentage applied here in the range of -20 to +20 is applied to the watering times for the auto program that have been setup on the Zone Setup page, coupled with the Area Setup page seasonal duration factors to arrive at an actual zone watering time.

10.6.19 Miscellaneous Options

These options provide zone control selections and command redundancy or safety.

10.6.20 Site Name

The name entered here can be used as the filename of a picture or drawing of the site layout off all areas and zones. This picture then can be viewed by clicking on picture icon on the General Status page for the device with the entered site name.

10.6.21 Valve Safety

A command is normally given once for each control action to be taken. It is possible to repeat the command to assure that the valve controller does recognize it. As added safety it possible to send OFF commands every hour and/or every new day to all valves that are currently suppose to be off.

10.6.22 Pump Safety

A pump is normally controlled the same as a valve with a single command to turn on and then a single command to turn off. It is not desirable that a pump be on when no valve is open such as might occur if the valve has failed or if the pump off command was not acted upon. When the pump safety is enabled then the pump off command will be delivered every 60 seconds when no zone in the pump's area is on.

10.6.23 Control Log

A log of valve control actions is maintained and can be viewed from a browser link. This log will include the ON and OFF commands. If desired it can include the STATUS_REQUEST and STATUS_ON/STATUS_OFF used for the Rain8X10-2 to assure that the command was accepted.

10.7 Setup7 - Remote Control

Remote Control Activation Setup
Manual control of individual zones can be achieved with a Browser, Voice, or RF Remote Pad. The Browse control will be via use of the button provided on the browser page. The voice uses the syntax illustrated in the third column of this table where the valve name used is the one setup on the Wiring Setup Page. When the voice command does not include the number of minutes then it will default to the manual minutes defined on the Zones Setup page. The RF Remote Pad address to zone relationship is entered in the last column of this table.

10.7.1 W800 for Handheld Wireless Input

If a W800 is interfaced to this computer and is to be used for handheld remote input then enter the serial com port on which the W800 is installed. A handheld remote may be a palm pad or other X10-type wireless device. The entries in this section indicate where the W800 is interfaced and the sensitivity to multiple button pushes.

10.7.2 Crestron Serial

Remote control of Rain8Net valves can be achieved with a serial port connection to a Crestron processor and associated Crestron system components. The port number used on the PC is entered in the setup text box. A crossover RS232 cable is needed between the Crestron and PC to make the physical connection for this form of external control.

10.7.3 Voice Recognition and Reporting

Voice recognition can be enabled to accept voice commands to control valves or to request the status of pending valve actions. If not checked then VR and TTS are not enabled. When enabled then voice commands per the sample patterns shown on the browser page can be used to active controls or obtain current and pending status.

10.7.4 Direct Valve Control

Valves can be remotely controlled by using the direct X10 device code or an alias device to perform the control. This option disables the remote control by use of the same X10 codes as the valve. This would be selected to prevent extraneous X10 commands from controlling the irrigation.

10.7.5 Disable Alias Valve Control

Valves can be remotely controlled by using the direct X10 device code or an alias device to perform the control. This option disables the remote control via the alias devices. This would be selected so remote is only enabled during specific times thus preventing unexpected irrigation control.

10.7.6 Remote Control Activation Setup

This section allows an X10 code to be associated with a zone. This X10 code is called the alias device. It is normally an RF to allow the irrigation field to be walked and the zones controlled. It can also be a power line X10 as well.

10.7.7 Zone

The zone name is the same as the name entered in the Wiring Setup page. It is used to identify the desired valve as part of the voice command.

10.7.8 Valve

The valve ID is the same as the valves selected in the Rain8 Setup page. It is used here only aid in identification of the desired value.

10.7.9 Voice

Two forms of voice syntax are shown to illustrate the command expected. The general form is the word Turn followed by On, Off, or the zone name. The third word in the command phrase will be the zone name or on, or off depending upon the second word. In the case of an ON command an optional number of minutes can be spoken followed by the word minutes.

10.7.10 RF Code

The RF address that is associated with the zone is entered in the box. When this RF code is received then the zone will turn ON for the manual minutes or turn OFF, depending upon the RF command. The manual minutes are entered on the Zone Setup page.

10.8 Setup8 - Weather

10.8.1 Time and Weather Setup

Sunrise, sunset and weather information are based upon location. The zip code is used to determine the location.

Weather data is obtained from the Internet with the zip code as the means of identification of the local vicinity. The forecast data is provided by AccuWeather, NWS or WeatherUnderground. The AWS or WeatherUnderground network of reporting sites provides the current weather data. Up to three sites can be selected. The primary will be used unless it fails to report then the other sites will be used. This will provide forecast information and default ET profile.

ET Calculations require a measure of the solar radiation which is generally not directly available. mcsSprinklers estimates this value based upon other weather-related information. A calibration factor is provided to allow refinement of this estimate for a specific location. The nominal value is 1. If increased to 1.5 then the ET will be approximately increased by a factor of 1.5. This will yield moisture loss at 1.5 times the initial estimated rate.

10.8.2 Optional Alternate Weather Source

Current weather conditions can be obtained from either AWS sites or WeatherUnderground sites. The AWS stations are shown for the selected zip code while the WeatherUnderground station codes are entered based upon viewing the below link and navigating to your location. In general they both provide the same set of weather data used by mcsSprinklers, but in some WeatherUnderground sites the Solar Radiation and UV are also available.

http://www.wunderground.com/weatherstation/ListStations.asp?selectedState=WA&selectedCountry=United+States.

Multiple stations can be selected from either provider, but only one provider can be used at time.

10.8.3 Optional Alternate Forecast Source

Weather forecast and solar data can be obtained from AccuWeather, NWS or WeatherUnderground. When obtained from WeatherUnderground a API license key must be obtained. See paragraph 4.2.6 for registration information for WeatherUnderground forecast feed. NWS data is based upon latitude and longitude so no additional entries are needed when using NWS.

10.8.4 Optional Local Weather Source

When a local weather station is available it can provide the most customized current conditions information. Weather stations can be interfaced via an IP LAN connection for the Weatherhawk weather station or via a comma-separated data file for most other weather stations that support a PC interface. If the IP interface is used, then the IP address is entered on the setup. If a data file is used, then the path to the data file is entered and this can be aided by browsing the file system.

10.8.5 Weather Sensor Source

Various internet and local weather station sources of weather sensor and forecast can be used. In some case one source may provide more reliable data that another source. Each sensor source that is to be used by

mcsSprinklers can be individually selected from the available sources that have been identified from the various optional sources. In some cases only the sensor source needs to be selected. Where additional parameters, such as the column position of a data file source are needed an entry position will be made available to make that entry.

10.8.6 Method to Download Internet Data

Two approaches to download internet data area provided. The option also exists to not obtain weather and forecast information from the internet. The default download method uses a separate control (.NET) while the other uses core functions within Windows. The preferred is .NET, but the other is available if problems exist with the primary method.

10.9 Setup9 - Other

10.9.1 Version Options Displayed

mcsSprinklers runs in either of three set of capabilities enabled with the highest level available dependent upon the license obtained. Selection of a lower version is primarily intended for trial mode evaluation and can also be advantageous during the interview process to allow essential setup to first be performed and then the more advances setup later.

10.9.2 Configuration Administration

Setup configurations can be saved and restored to accommodate different control configurations. An auto backup is produced each time a configuration change is made. This time-tagged backup can be restored as well.

10.9.3 Load Configuration

Saved configurations can be loaded that exists on either the host computer or the client computer.
A pull down selection of all previously saved configurations on the host computer is presented or a file system browse button is available for finding the files on the client computer. When one is selected the current configuration will be restored to the selected one. If configurations are available on the client (browser's computer) then they can uploaded to the host by browsing the client file system for the desired ini file.

10.9.4 Save Configuration

Configurations can be saved on the host computer and each is identified by a user-entered name. After the name is entered the Save button is used to actually perform the save of the current configuration.

10.9.5 Restore Configuration from Auto Backup

Each time the Save Changes button is used to record a change to the current configuration a backup is automatically made. The configuration can be restored from this prior state by selecting it from the pull down. Up to ten backups will be saved.

10.9.6 Update mcsSprinklers Version from Web or Local Backup

mcsSprinklers updated are often available. The latest available is shown on the Version column for "Web" in this section. This is updated each midnight or with use of the Refresh button on the same row. If the Update button is used then the current version will be replaced by the one from the web site. The current one will become a backup and can be reloaded by selecting to restore from local on the desired row of this section. Each version update will result in a restart of mcsSprinklers.

10.9.7 HTTP Browser Interface

Browser interface to mcsSprinklers is via a specific port to provide maximum security. A few ports have specific purposes, but most are available.

10.9.8 Browser Display Options

The colors and general style of the browser user interface presentation can be altered to better suit user preferences. The overall style is controlled by the style sheet. Individual foreground colors and the overall background colors are independent of the style sheet. The icon size on the General Status page can also be adjusted as well as the overall width of the tables in which the data is formatted.

The General Status and Zone Status pages have information that can change over time. The Refresh setting in this section is used to identify the interval at which the browser page will update for these two status pages.

The browser size and position can be explicitly controlled by setting the four browser window settings. This will assure that the browser will always be the same each time a mcsSprinklers page displayed. If they are left blank then the browser will appear per the Windows default position and size algorithm.

A MCS or Homeseer logo exists in the page title area in the upper right of each mcsSprinklers page. Clicking on this logo will redirect the browser to the URL entered into the setup. If the URL entry is blank the redirection will be to the General Status page of mcsSprinklers. The use of a user-specified URL will enable convenient exit from mcsSprinklers to other browser pages.

The touch pages contain a picture of the zone with overlaid text that contains the zone identification. This identification can be set to include the zone device code and location or just the location.

In a Homeseer configuration the Rain8Net/UPB device codes are special characters that are at times awkward to view. Rather than showing these code for identification a Z## nomenclature can be used where the ## is a sequential number.

The popup charts that show annual trends for sensor and computed values can be displayed in HTML or Flash. The Flash is a more pleasing display format if the computer supports Macromedia Flash.

10.9.9 Popup Calendar Characteristics

A calendar view is generated by clicking a calendar icon. It will show a user-specified number of historical days and future days until the next scheduled irrigation time. The calendar can have scroll bars applied which is appropriate for longer history.

10.9.10 Sensor Units of Measure

Allow to change from English units to metric units when the checkbox is checked. This applies to the display of the data as well as the download.

10.9.11 Email Notification

Email can be delivered when major events occur. These events consist of loss of internet weather or forecast and change in redundancy configuration and unexpected software operations. The email address to deliver the notification is entered into the text box.

The delivery of email will use the same SMTP server for which your Email is provided. The access information to use this server needs to be entered. To confirm a proper setup a button is provided to send a test email.

When email is delivered a copy can also be sent to mcsSprinklers.com to provide input for support.

Some may have difficulty using the internal email function due to setup demands of their service provider. There is a free SMTP product that can be loaded on the same computer where MCS runs. It is available at softstack.com/freesmtp.html. Their instructions say to put localhost in the smtp blank of the client but 127.0.0.1 in both the SMTP and POP3 boxes may yield better results. The destination email also needs to be setup there.

10.9.12 Login Username and Password for Internet (WAN) Access

Access to mcsSprinklers via a browser from within the household or LAN is allowed with no special security provisions other than knowledge of the browser URL that should be used. The assumption is that any user that has local access also has authorization.

When the access is from an external location over the internet then authentication can be requested to prevent unintentional access to the setup and control of the irrigation system. A username and password is used to provide this authorization. The username is visible and the password is encrypted on the mcsSprinklers setup. If no username is entered in the setup then no authentication will be requested from users over the internet.

10.9.13 Redundancy Backup Mode

A single computer configuration is enabled by selecting either or both self-monitoring or restart at midnight. In this case a second application "RESTART" will be started that monitors the behavior of mcsSprinklers and will restart if it exists, fails to produce heartbeat or at the start of each day.
A dual computer configuration is enabled by selecting either Standby Backup or Active Backup on both computers where mcsSprinklers is installed. The transition from standby to active is made when the active computer fails to report for the specified takeover period. Most setup information is maintained on only one computer and this is designated as the primary. The path to the mcsSprinklers install on the primary computer is used by the secondary computer to access the setup information.

10.9.14 Launch Redundant Applications on Startup

[Version-Dependent Capability] Dedicated interfaces are built into mcsSprinklers and it supports use of external interfaces using xAP message protocol. The primary purpose of the multiple interface approach is for system configurations where redundancy is used to increase availability. When launched, a tray icon will appear for the external applications and they will be the primary interface until a failure is detected.

10.9.15 Rain8 Interfaces

xapmcsCM11A and xapmcsCM17A are the supported interfaces for power line and wireless control.

10.9.16 Control Interfaces

xapmcsVoice and xapmcsW800 are the supported interfaces for voice control and wireless remote pad control.

10.9.17 Data Collection

xapmcsAWS and xapmcsWeatherXML are the supported interfaces to gather current and forecast weather information.

10.9.18 Supplemental xAP Interface

When a checkbox is checked xAP message schema is activated. BSC and Configuration are bidirectional and the others are sent from mcsSprinklers. The start Hub checkbox should be checked if no other hub is present and other xAP applications are running on the same computer.

10.9.19 Homeseer Devices

A Homeseer device can be controlled as a valve protect device to accept the transient ON/OFF loads as zone valves are switched can be specified. This device will turn OFF before any zone value is turned OFF and will turn ON after the zone valve has been set to the ON position. This can also be used to simulate a master valve for the entire site.

The Remote setup page assumes an X10 RF type device to be used for remote activation. If other virtual devices are used for this purpose then the alternate HS interface is indicated via checkbox.

On/Off as conveyed in the Homeseer DeviceStatus is the normal valve control mechanism. If 0/1 using the DeviceValue is to be used then this is indicated via checkbox.

10.9.20 Homeseer Notification Options

mcsSprinklers maintains its log of valve actions and is visible from the Run Log link. The valve actions can also be sent to the Homeseer log. The internally managed hardware (i.e. Rain8Net) valve actions will not normally be available to the Homeseer log, but this option can be selected. The Homeseer log can also be the repository for changes in the reason an Area is inhibited.

10.9.21 Homeseer Display Options

The browser pages can be formatted without header content for display in dedicated applications. When this option is selected it will suppress the contents at the top of each display page. It can also be formatted using a custom header.

10.9.22 Database Options

SQL, mySQL, SQLite or Access options are available. If Access or SQLite is used then enter full path to the database .mdb/db file. If SQL or mySQL is used then enter the name of the SQL table. Different version of MySQL and MS SQL Server have different connection mechanisms so this will affect the information entered during setup.

MS SQL Server has provisions for security based upon the Windows login credentials or based upon a username/password explicitly for the database instance. If the Windows login credentials are used then the username/password fields are left blank on the mcsSprinklers setup. MySQL requires the database to have a username/password.

For MS SQL and MySQL the database is identified by a simple name such as “mcsSprinklers”. For Access and SQLite the database is a file path. It will be type “.db” for SQLite and “.mdb” for Access.

The SQL Source identifies the instance of the MySQL or MS SQL server. In some versions this can be left blank so the default server on the network will be used. In other cases and especially in the express versions of MS SQL an explicit instance name needs to be specified. In earlier Express versions the instance id is sufficient (e.g. SQLEXPRESS). In later versions both the computer/network name is needed and the instance (e.g. MYCOMPUTER\MYINSTANCE). Later versions have tigher security. If mcsSprinkres and MY SQL are on the same computer and integrated security it used then the setup of SQL Source will append “;Trusted_Connection=True” (e.g. MYCOMPUTER\MYINSTANCE;Trusted_Connection=True). If the database is on another computer then the integrated security cannot be used.

10.9.23 Help

Help is available in document form and in context of the setup being performed. Debugging options also exists to assist in troubleshooting unexpected behaviors.

10.9.24 Context Help

When the mouse hovers over the dark headers of each setup page a popup window will appear to provide information about the setup options within that area. This popup can be disabled with the mouse over header checkbox.

Expert mode makes all possible setting visible on the setup page. When not checked then only settings that are necessary based upon interview responses are shown on the setup pages.

10.9.25 Debug Data Files

Debug information can be logged to text files. The general debug will contain scheduling and control information. For most analysis activities there are four pieces of information that are needed. One is the mcsSprinklers.ini file that contains the configuration. The second is StartupTrace.txt file that constraints the information shown on the Message Page. The third is the detail debug information that is in the General Debug file. This debug file has a file name that contains the date at which the file was created. A new file is created with each restart, each new day, and upon use of the Write button. The last piece of information is a description of what the observed failure is, the approximate time it happened and the actions taken that caused it. If the observed failure happened with the software as you are now running it then you need to flush the debug information to a file. You do this with the Write button in the Debug area. This will flush the buffered debug information to a General Debug file and create a new General Debug file.

The GeneralDebug file of interest will be the one that was just closed and not the one that was just created since then new one contains only future debug information. When sending debug information be careful to send a file that spans the time when a failure is observed. The file name will contain the time it started and the File Last Modified Date will show the last time data was written to the file. These are both visible in Debug File section. For all except the currently active file these two dates will show the date range for which the data was collected.

The easiest way to provide the necessary files is to use the Email button on the Other Page on the row that the debug file of interest. This email to yourself will contain the mcsSprinklers.ini, StartupTrace.txt and selected GeneralDebug files so all that needs to be done is forward this email and include a description of the problem.

The folder size where debug files are located can be limited to not exceed available memory capacity. This is especially important on the embedded platforms where memory is limited. This user setting defaults to 100 megabytes. It is also possible to use an external drive to collect this data and in that case the path is entered to this drive.

10.9.26 Version Options Displayed

The degree of configurability is based upon the license obtained. To simply the configuration it may be desirable to reconfigure to a version that has fewer setup options. Only those versions available for the license obtained will be displayed. If the version is changed then mcsSprinklers should be restarted.

10.10 Setup10 – xAP Reporting

When the “Basic Status and Control” checkbox in the Supplemental xAP Interface section of the “Other” setup page is checked then the xAP Reporting page is made available via a browser link at the top of page. The xAP Reporting page will itemize all the control and status devices maintained by mcsSprinklers and include two checkboxes for each. The BSC checkbox, when checked, will generate a xAP BSC schema message for each change in the value of the device. This page is shown in Figure 30.

10.11 Setup11 – Picture Entry

10.11.1 Pictures

Pictures of the zone that a valve controls can be selected and these pictures will be available during the setup and during general monitoring of the irrigation. The source pictures can be any size and can come from any location on the client's computer network. The Browse buttons are used to locate the original pictures. mcsSprinklers will copy, resize and label these pictures for service via the browser through which access to mcsSprinklers is made.

Use of pictures is optional. When a display of a picture is available the camera icon will appear in the applicable context.

11 AccuWeather Location Codes

Country	City	Location Code
Afghanistan	Herat, AF	ASI|AF|AF011|HERAT
Afghanistan	Kabul, AF	ASI|AF|AF013|KABUL
Afghanistan	Kandahar, AF	ASI|AF|AF014|KANDAHAR
Afghanistan	Mazar-I-Sharif, AF	ASI|AF|AF004|MAZAR-I-SHARIF
Albania	Tirana, AL	EUR|AL|AL024|TIRANA
Algeria	Alger, DZ	AFR|DZ|AG004|ALGER
Algeria	Annaba, DZ	AFR|DZ|AG039|ANNABA
Algeria	Batna, DZ	AFR|DZ|AG006|BATNA
Algeria	Bechar, DZ	AFR|DZ|AG007|BECHAR
Algeria	Bejaia, DZ	AFR|DZ|AG008|BEJAIA
Algeria	Biskra, DZ	AFR|DZ|AG009|BISKRA
Algeria	Blida, DZ	AFR|DZ|AG010|BLIDA
Algeria	Chlef, DZ	AFR|DZ|AG014|CHLEF
Algeria	Constantine, DZ	AFR|DZ|AG015|CONSTANTINE
Algeria	Mostaganem, DZ	AFR|DZ|AG030|MOSTAGANEM
Algeria	Oran, DZ	AFR|DZ|AG032|ORAN
Algeria	Setif, DZ	AFR|DZ|AG037|SETIF
Algeria	Sidi-Bel-Abbes, DZ	AFR|DZ|AG038|SIDI-BEL-ABBES
Algeria	Skikda, DZ	AFR|DZ|AG015|SKIKDA
Algeria	Tebessa, DZ	AFR|DZ|AG042|TEBESSA
Algeria	Tiaret, DZ	AFR|DZ|AG043|TIARET
American Samoa	Pago Pago, AS	OCN|AS|AS000|PAGO PAGO
Andorra	Andorra La Vella, AD	EUR|AD|AN000|ANDORRA LA VELLA
Angola	Benguela, AO	AFR|AO|AO002|BENGUELA
Angola	Huambo, AO	AFR|AO|AO002|HUAMBO
Angola	Lobito, AO	AFR|AO|AO007|LOBITO
Angola	Luanda, AO	AFR|AO|AO006|LUANDA
Angola	Lubango, AO	AFR|AO|AO010|LUBANGO
Antigua And Barbuda	Saint John, AG	CAC|AG|AC003|SAINT JOHN
Argentina	Avellaneda, AR	SAM|AR|AR001|AVELLANEDA
Argentina	Bahia Blanca, AR	SAM|AR|AR001|BAHÍA BLANCA
Argentina	Buenos Aires, AR	SAM|AR|AR007|BUENOS AIRES
Argentina	Catamarca, AR	SAM|AR|AR002|CATAMARCA
Argentina	Comodoro Rivadavia, AR	SAM|AR|AR004|COMODORO RIVADAVIA
Argentina	Concordia, AR	SAM|AR|AR008|CONCORDIA
Argentina	Cordoba, AR	SAM|AR|AR005|CÓRDOBA
Argentina	Corrientes, AR	SAM|AR|AR006|CORRIENTES
Argentina	Formosa, AR	SAM|AR|AR009|FORMOSA
Argentina	General San Martin, AR	SAM|AR|AR011|GENERAL SAN MARTÍN

Argentina	La Plata, AR	SAM|AR|AR001|LA PLATA
Argentina	Lanus, AR	SAM|AR|AR001|LANUS
Argentina	Lomas De Zamora, AR	SAM|AR|AR001|LOMAS DE ZAMORA
Argentina	Mar Del Plata, AR	SAM|AR|AR001|MAR DEL PLATA
Argentina	Mendoza, AR	SAM|AR|AR013|MENDOZA
Argentina	Moron, AR	SAM|AR|AR001|MORÓN
Argentina	Neuquen, AR	SAM|AR|AR015|NEUQUÉN
Argentina	Parana, AR	SAM|AR|AR022|PARANÁ
Argentina	Posadas, AR	SAM|AR|AR014|POSADAS
Argentina	Quilmes, AR	SAM|AR|AR001|QUILMES
Argentina	Resistencia, AR	SAM|AR|AR003|RESISTENCIA
Argentina	Rio Cuarto, AR	SAM|AR|AR005|RÍO CUARTO
Argentina	Rosario, AR	SAM|AR|AR021|ROSARIO
Argentina	Salta, AR	SAM|AR|AR017|SALTA
Argentina	San Fernando, AR	SAM|AR|AR001|SAN FERNANDO
Argentina	San Isidro, AR	SAM|AR|AR001|SAN ISIDRO
Argentina	San Juan, AR	SAM|AR|AR018|SAN JUAN
Argentina	San Nicolas, AR	SAM|AR|AR001|SAN NICOLÁS
Argentina	San Salvador De Jujuy, AR	SAM|AR|AR010|SAN SALVADOR DE JUJUY
Argentina	Santa Fe, AR	SAM|AR|AR021|SANTA FÉ
Argentina	Santiago Del Estero, AR	SAM|AR|AR022|SANTIAGO DEL ESTERO
Argentina	Tucuman, AR	SAM|AR|AR024|SAN MIGUEL DE TUCUMÁN
Argentina	Vicente Lopez, AR	SAM|AR|AR001|VICENTE LÓPEZ
Armenia	Kirovakan, AM	ASI|AM|AM006|KIROVAKAN
Armenia	Leninakan, AM	ASI|AM|AM007|LENINAKAN
Armenia	Yerevan, AM	ASI|AM|AM011|YEREVAN
Australia	Adelaide, AU	OCN|AU|SA|ADELAIDE
Australia	Brisbane, AU	OCN|AU|QLD|BRISBANE
Australia	Cairns, AU	OCN|AU|QLD|CAIRNS
Australia	Canberra, AU	OCN|AU|ACT|CANBERRA
Australia	Darwin, AU	OCN|AU|NT|DARWIN
Australia	Geelong, AU	OCN|AU|VIC|GEELONG
Australia	Gold Coast, AU	OCN|AU|QLD|GOLD COAST
Australia	Hobart, AU	OCN|AU|TAS|HOBART
Australia	Melbourne, AU	OCN|AU|VIC|MELBOURNE
Australia	Newcastle, AU	OCN|AU|NSW|NEWCASTLE
Australia	Perth, AU	OCN|AU|WA|PERTH
Australia	Sydney, AU	OCN|AU|NSW|SYDNEY
Australia	Townsville, AU	OCN|AU|QLD|TOWNSVILLE
Australia	Wollongong, AU	OCN|AU|NSW|WOLLONGONG
Austria	Graz, AT	EUR|AT|AU006|GRAZ

Austria	Innsbruck, AT	EUR|AT|AU007|INNSBRUCK
Austria	Linz, AT	EUR|AT|AU004|LINZ
Austria	Salzburg, AT	EUR|AT|AU005|SALZBURG
Austria	Vienna, AT	EUR|AT|AU009|WIEN
Azerbaijan	Baku, AZ	ASI|AZ|AJ009|BAKU
Azerbaijan	Gandja, AZ	ASI|AZ|AJ020|GANDJA
Azerbaijan	Sumgait, AZ	ASI|AZ|AJ052|SUMGAIT
Bahrain	Manama, BH	MEA|BH|BA002|MANAMA
Bangladesh	Barisal, BD	ASI|BD|BG003|BARISAL
Bangladesh	Chittagong, BD	ASI|BD|BG001|CHITTAGONG
Bangladesh	Comilla, BD	ASI|BD|BG001|COMILLA
Bangladesh	Dhaka, BD	ASI|BD|BG002|DHAKA
Bangladesh	Dinajpur, BD	ASI|BD|BG004|DINAJPUR
Bangladesh	Jamalpur, BD	ASI|BD|BG004|JAMALPUR
Bangladesh	Jessore, BD	ASI|BD|BG003|JESSORE
Bangladesh	Khulna, BD	ASI|BD|BG003|KHULNA
Bangladesh	Mymensingh, BD	ASI|BD|BG002|MYMENSINGH
Bangladesh	Narayanganj, BD	ASI|BD|BG002|NARAYANGANJ
Bangladesh	Nawabganj, BD	ASI|BD|BG002|NAWABGANJ
Bangladesh	Pabna, BD	ASI|BD|BG004|PABNA
Bangladesh	Rajshahi, BD	ASI|BD|BG004|RAJSHAHI
Bangladesh	Rangpur, BD	ASI|BD|BG004|RANGPUR
Bangladesh	Saidpur, BD	ASI|BD|BG004|SAIDPUR
Bangladesh	Tangail, BD	ASI|BD|BG002|TANGAIL
Bangladesh	Tongi, BD	ASI|BD|BG002|TONGI
Barbados	Bridgetown, BB	CAC|BB|BB008|BRIDGETOWN
Belarus	Baranovichi, BY	EUR|BY|BO001|BARANOVICHI
Belarus	Bobruisk, BY	EUR|BY|BO005|BOBRUISK
Belarus	Borisov, BY	EUR|BY|BO004|BORISOV
Belarus	Brest, BY	EUR|BY|BO001|BREST
Belarus	Gomel, BY	EUR|BY|BO002|GOMEL
Belarus	Grodno, BY	EUR|BY|BO003|GRODNO
Belarus	Lida, BY	EUR|BY|BO003|LIDA
Belarus	Minsk, BY	EUR|BY|BO000|MINSK
Belarus	Mogilev, BY	EUR|BY|BO005|MOGILEV
Belarus	Novopolotsk, BY	EUR|BY|BO000|NOVOPOLOTSK
Belarus	Orsha, BY	EUR|BY|BO007|ORSHA
Belarus	Pinsk, BY	EUR|BY|BO001|PINSK
Belarus	Soligorsk, BY	EUR|BY|BO004|SOLIGORSK
Belarus	Vitebsk, BY	EUR|BY|BO007|VITEBSK
Belgium	Antwerpen, BE	EUR|BE|BE001|ANTWERPEN
Belgium	Brugge, BE	EUR|BE|BE011|BRUGGE
Belgium	Bruxelles, BE	EUR|BE|BE003|BRUXELLES

Belgium	Charleroi, BE	EUR|BE|BE004|CHARLEROI
Belgium	Gent, BE	EUR|BE|BE009|GENT
Belgium	Liege, BE	EUR|BE|BE005|LIÈGE
Belgium	Namur, BE	EUR|BE|BE008|NAMUR
Belize	Belmopan, BZ	CAC|BZ|BH002|BELMOPAN
Benin	Cotonou, BJ	AFR|BJ|BN000|COTONOU
Benin	Parakou, BJ	AFR|BJ|BN000|PARAKOU
Benin	Porto-Novo, BJ	AFR|BJ|BN000|PORTO-NOVO
Bermuda	Hamilton, BM	NAM|BM|BD002|HAMILTON
Bhutan	Thimphu, BT	ASI|BT|BT016|THIMPHU
Bolivia	Cochabamba, BO	SAM|BO|BL002|COCHABAMBA
Bolivia	La Paz, BO	SAM|BO|BL004|LA PAZ
Bolivia	Oruro, BO	SAM|BO|BL005|ORURO
Bolivia	Potosi, BO	SAM|BO|BL007|POTOSÍ
Bolivia	Santa Cruz, BO	SAM|BO|BL003|SANTA CRUZ
Bolivia	Sucre, BO	SAM|BO|BL001|SUCRE
Bolivia	Tarija, BO	SAM|BO|BL009|TARIJA
Bosnia And Herzegovina	Banja Luka, BA	EUR|BA|BK002|BANJA LUKA
Bosnia And Herzegovina	Doboj, BA	EUR|BA|BK002|DOBOJ
Bosnia And Herzegovina	Mostar, BA	EUR|BA|BK001|MOSTAR
Bosnia And Herzegovina	Prijedor, BA	EUR|BA|BK002|PRIJEDOR
Bosnia And Herzegovina	Sarajevo, BA	EUR|BA|BK001|SARAJEVO
Bosnia And Herzegovina	Tuzla, BA	EUR|BA|BK001|TUZLA
Bosnia And Herzegovina	Zenica, BA	EUR|BA|BK001|ZENICA
Botswana	Francistown, BW	AFR|BW|BC000|FRANCISTOWN
Botswana	Gaborone, BW	AFR|BW|BC009|GABORONE
Botswana	Ghanzi, BW	AFR|BW|BC000|GHANZI
Botswana	Kanye, BW	AFR|BW|BC000|KANYE
Botswana	Kasane, BW	AFR|BW|BC000|KASANE
Botswana	Mahalapye, BW	AFR|BW|BC000|MAHALAPYE
Botswana	Mamuno, BW	AFR|BW|BC000|MAMUNO
Botswana	Maun, BW	AFR|BW|BC000|MAUN
Botswana	Molepolole, BW	AFR|BW|BC000|MOLEPOLOLE
Botswana	Selebi-Phikwe, BW	AFR|BW|BC001|SELEBI-PHIKWE
Botswana	Serowe, BW	AFR|BW|BC000|SEROWE
Botswana	Tshabong, BW	AFR|BW|BC000|TSHABONG
Brazil	Alagoinhas, BR	SAM|BR|BR002|ALAGOINHAS

Brazil	Alvorada, BR	SAM|BR|BR004|ALVORADA
Brazil	Americana, BR	SAM|BR|BR023|AMERICANA
Brazil	Ananindeua, BR	SAM|BR|BR013|ANANINDEUA
Brazil	Anapolis, BR	SAM|BR|BR027|ANÁPOLIS
Brazil	Apucarana, BR	SAM|BR|BR015|APUCARANA
Brazil	Aracaju, BR	SAM|BR|BR024|ARACAJU
Brazil	Aracatuba, BR	SAM|BR|BR023|ARAÇATUBA
Brazil	Araguaina, BR	SAM|BR|BR025|ARAGUAINA
Brazil	Arapiraca, BR	SAM|BR|BR002|ARAPIRACA
Brazil	Araraquara, BR	SAM|BR|BR023|ARARAQUARA
Brazil	Araras, BR	SAM|BR|BR023|ARARAS
Brazil	Atibaia, BR	SAM|BR|BR023|ATIBAIA
Brazil	Bage, BR	SAM|BR|BR019|BAGÉ
Brazil	Barbacena, BR	SAM|BR|BR012|BARBACENA
Brazil	Barra Mansa, BR	SAM|BR|BR017|BARRA MANSA
Brazil	Barreiras, BR	SAM|BR|BR005|BARREIRAS
Brazil	Barretos, BR	SAM|BR|BR023|BARRETOS
Brazil	Barueri, BR	SAM|BR|BR023|BARUERI
Brazil	Bauru, BR	SAM|BR|BR023|BAURU
Brazil	Belem, BR	SAM|BR|BR013|BELÉM
Brazil	Belford Roxo, BR	SAM|BR|BR017|BELFORD ROXO
Brazil	Belo Horizonte, BR	SAM|BR|BR012|BELO HORIZONTE
Brazil	Betim, BR	SAM|BR|BR012|BETIM
Brazil	Boa Vista, BR	SAM|BR|BR021|BOA VISTA
Brazil	Botucatu, BR	SAM|BR|BR023|BOTUCATU
Brazil	Braganca Paulista, BR	SAM|BR|BR023|BRAGANÇA PAULISTA
Brazil	Brasilia, BR	SAM|BR|BR007|BRASILIA
Brazil	Cabo Frio, BR	SAM|BR|BR017|CABO FRIO
Brazil	Cachoeirinha, BR	SAM|BR|BR015|CACHOEIRINHA
Brazil	Cachoeiro De Itapemirim, BR	SAM|BR|BR008|CACHOEIRO DE ITAPEMIRIM
Brazil	Camacari, BR	SAM|BR|BR005|CAMACARI
Brazil	Camaragibe, BR	SAM|BR|BR026|CAMARAGIBE
Brazil	Campina Grande, BR	SAM|BR|BR014|CAMPINA GRANDE
Brazil	Campinas, BR	SAM|BR|BR023|CAMPINAS
Brazil	Campo Grande, BR	SAM|BR|BR010|CAMPO GRANDE
Brazil	Canoas, BR	SAM|BR|BR019|CANOAS
Brazil	Carapicuiba, BR	SAM|BR|BR023|CARAPICUÍBA
Brazil	Cariacica, BR	SAM|BR|BR008|CARIACICA
Brazil	Caruaru, BR	SAM|BR|BR026|CARUARU
Brazil	Cascavel, BR	SAM|BR|BR006|CASCAVEL
Brazil	Castanhal, BR	SAM|BR|BR013|CASTANHAL
Brazil	Catanduva, BR	SAM|BR|BR023|CATANDUVA

Brazil	Caucaia, BR	SAM|BR|BR006|CAUCAIA
Brazil	Caxias, BR	SAM|BR|BR009|CAXIAS
Brazil	Caxias Do Sul, BR	SAM|BR|BR019|CAXIAS DO SUL
Brazil	Chapeco, BR	SAM|BR|BR022|CHAPECÓ
Brazil	Codo, BR	SAM|BR|BR009|CODO
Brazil	Colombo, BR	SAM|BR|BR015|COLOMBO
Brazil	Contagem, BR	SAM|BR|BR012|CONTAGEM
Brazil	Cotia, BR	SAM|BR|BR023|COTIA
Brazil	Crato, BR	SAM|BR|BR006|CRATO
Brazil	Criciuma, BR	SAM|BR|BR022|CRICIÚMA
Brazil	Cubatao, BR	SAM|BR|BR023|CUBATAO
Brazil	Cuiaba, BR	SAM|BR|BR010|CUIABÁ
Brazil	Curitiba, BR	SAM|BR|BR015|CURITIBA
Brazil	Diadema, BR	SAM|BR|BR023|DIADEMA
Brazil	Divinopolis, BR	SAM|BR|BR012|DIVINÓPOLIS
Brazil	Dourados, BR	SAM|BR|BR011|DOURADOS
Brazil	Duque De Caxias, BR	SAM|BR|BR017|DUQUE DE CAXIAS
Brazil	Embu, BR	SAM|BR|BR023|EMBU
Brazil	Feira De Santana, BR	SAM|BR|BR005|FEIRA DE SANTANA
Brazil	Ferraz De Vasconcelos, BR	SAM|BR|BR023|FERRAZ DE VASCONCELOS
Brazil	Florianopolis, BR	SAM|BR|BR022|FLORIANÓPOLIS
Brazil	Fortaleza, BR	SAM|BR|BR006|FORTALEZA
Brazil	Foz Do Iguacu, BR	SAM|BR|BR015|FOZ DO IGUAÇU
Brazil	Franca, BR	SAM|BR|BR005|FRANCA
Brazil	Francisco Morato, BR	SAM|BR|BR023|FRANCISCO MORATO
Brazil	Franco Da Rocha, BR	SAM|BR|BR023|FRANCO DA ROCHA
Brazil	Garanhuns, BR	SAM|BR|BR026|GARANHUNS
Brazil	Goiania, BR	SAM|BR|BR027|GOIÂNIA
Brazil	Governador Valadares, BR	SAM|BR|BR012|GOVERNADOR VALADARES
Brazil	Gravatai, BR	SAM|BR|BR019|GRAVATAI
Brazil	Guarapuava, BR	SAM|BR|BR015|GUARAPUAVA
Brazil	Guaratingueta, BR	SAM|BR|BR023|GUARATINGUETÁ
Brazil	Guaruja, BR	SAM|BR|BR023|GUARUJÁ
Brazil	Guarulhos, BR	SAM|BR|BR023|GUARULHOS
Brazil	Hortolandia, BR	SAM|BR|BR023|HORTOLANDIA
Brazil	Ibirite, BR	SAM|BR|BR012|IBIRITÉ
Brazil	Ilheus, BR	SAM|BR|BR005|ILHÉUS
Brazil	Imperatriz, BR	SAM|BR|BR009|IMPERATRIZ
Brazil	Indaiatuba, BR	SAM|BR|BR023|INDAIATUBA
Brazil	Ipatinga, BR	SAM|BR|BR012|IPATINGA
Brazil	Itabori, BR	SAM|BR|BR017|ITABORAÍ

Brazil	Itabuna, BR	SAM|BR|BR005|ITABUNA
Brazil	Itaituba, BR	SAM|BR|BR013|ITAITUBA
Brazil	Itajai, BR	SAM|BR|BR022|ITAJAÍ
Brazil	Itapecerica Da Serra, BR	SAM|BR|BR023|ITAPECERICA DA SERRA
Brazil	Itapetininga, BR	SAM|BR|BR026|ITAPETININGA
Brazil	Itapevi, BR	SAM|BR|BR023|ITAPEVI
Brazil	Itaquaquecetuba, BR	SAM|BR|BR023|ITAQUAQUECETUBA
Brazil	Itu, BR	SAM|BR|BR023|ITU
Brazil	Jacarei, BR	SAM|BR|BR023|JACAREÍ
Brazil	Jaragua, BR	SAM|BR|BR022|JARAGUÁ DO SUL
Brazil	Jau, BR	SAM|BR|BR023|JAÚ
Brazil	Jequie, BR	SAM|BR|BR023|JEQUIÉ
Brazil	Joao Pessoa, BR	SAM|BR|BR014|JOAO PESSOA
Brazil	Joinville, BR	SAM|BR|BR022|JOINVILLE
Brazil	Juazeiro, BR	SAM|BR|BR005|JUAZEIRO
Brazil	Juazeiro do Norte, BR	SAM|BR|BR006|JUÀZEIRO DO NORTE
Brazil	Juiz De Fora, BR	SAM|BR|BR012|JUIZ DE FORA
Brazil	Jundiai, BR	SAM|BR|BR023|JUNDIAÍ
Brazil	Lages, BR	SAM|BR|BR027|LAGES
Brazil	Limeira, BR	SAM|BR|BR023|LIMEIRA
Brazil	Linhares, BR	SAM|BR|BR008|LINHARES
Brazil	Londrina, BR	SAM|BR|BR015|LONDRINA
Brazil	Luziania, BR	SAM|BR|BR027|LUZIÂNIA
Brazil	Macae, BR	SAM|BR|BR017|MACAE
Brazil	Macapa, BR	SAM|BR|BR003|MACAPÁ
Brazil	Mage, BR	SAM|BR|BR017|MAGÉ
Brazil	Manaus, BR	SAM|BR|BR004|MANAUS
Brazil	Maraba, BR	SAM|BR|BR013|MARABA
Brazil	Maracanau, BR	SAM|BR|BR006|MARACANAU
Brazil	Marilia, BR	SAM|BR|BR023|MARÍLIA
Brazil	Maringa, BR	SAM|BR|BR015|MARINGÁ
Brazil	Maua, BR	SAM|BR|BR023|MAUÁ
Brazil	Moji Das Cruzes, BR	SAM|BR|BR023|MOJI DAS CRUZES
Brazil	Montes Claros, BR	SAM|BR|BR012|MONTES CLAROS
Brazil	Mosoro, BR	SAM|BR|BR018|MOSSORÓ
Brazil	Natal, BR	SAM|BR|BR018|NATAL
Brazil	Niteroi, BR	SAM|BR|BR017|NITERÓI
Brazil	Nossa Senhora Do Socorro, BR	SAM|BR|BR024|NOSSA SENHORA DO SOCORRO
Brazil	Nova Friburgo, BR	SAM|BR|BR017|NOVA FRIBURGO
Brazil	Nova Iguacu, BR	SAM|BR|BR017|NOVA IGUAÇU
Brazil	Novo Hamburgo, BR	SAM|BR|BR019|NÔVO HAMBURGO
Brazil	Olinda, BR	SAM|BR|BR026|OLINDA

Brazil	Osasco, BR	SAM|BR|BR023|OSASCO
Brazil	Palmas, BR	SAM|BR|BR015|PALMAS
Brazil	Paranagua, BR	SAM|BR|BR015|PARANAGUÁ
Brazil	Parnaiba, BR	SAM|BR|BR016|PARNAÍBA
Brazil	Passo Fundo, BR	SAM|BR|BR019|PASSO FUNDO
Brazil	Passos, BR	SAM|BR|BR012|PASSOS
Brazil	Patos De Minas, BR	SAM|BR|BR012|PATOS DE MINAS
Brazil	Paulista, BR	SAM|BR|BR026|PAULISTA
Brazil	Pelotas, BR	SAM|BR|BR019|PELOTAS
Brazil	Petrolina, BR	SAM|BR|BR026|PETROLINA
Brazil	Petropolis, BR	SAM|BR|BR017|PETRÓPOLIS
Brazil	Pindamonhangaba, BR	SAM|BR|BR023|PINDAMONHANGABA
Brazil	Pinhais, BR	SAM|BR|BR012|PINHAIS
Brazil	Piracicaba, BR	SAM|BR|BR023|PIRACICABA
Brazil	Pocos De Caldas, BR	SAM|BR|BR012|POÇOS DE CALDAS
Brazil	Ponta Grossa, BR	SAM|BR|BR015|PONTA GROSSA
Brazil	Porto Alegre, BR	SAM|BR|BR019|PORTO ALEGRE
Brazil	Porto Velho, BR	SAM|BR|BR020|PORTO VELHO
Brazil	Pouso Alegre, BR	SAM|BR|BR012|POUSO ALEGRE
Brazil	Praia Grande, BR	SAM|BR|BR023|PRAIA GRANDE
Brazil	Presidente Prudente, BR	SAM|BR|BR023|PRESIDENTE PRUDENTE
Brazil	Queimados, BR	SAM|BR|BR017|QUEIMADOS
Brazil	Recife, BR	SAM|BR|BR026|RECIFE
Brazil	Resende, BR	SAM|BR|BR017|RESENDE
Brazil	Ribeirao Das Neves, BR	SAM|BR|BR012|RIBEIRAO DAS NEVES
Brazil	Ribeirao Pires, BR	SAM|BR|BR023|RIBEIRAO PIRES
Brazil	Ribeirao Preto, BR	SAM|BR|BR023|RIBEIRAO PRÊTO
Brazil	Rio Branco, BR	SAM|BR|BR001|RIO BRANCO
Brazil	Rio Claro, BR	SAM|BR|BR017|RIO CLARO
Brazil	Rio De Janeiro, BR	SAM|BR|BR017|RIO DE JANEIRO
Brazil	Rio Grande, BR	SAM|BR|BR019|RIO GRANDE
Brazil	Rio Verde, BR	SAM|BR|BR027|RIO VERDE
Brazil	Rondonopolis, BR	SAM|BR|BR010|RONDONÓPOLIS
Brazil	Sabara, BR	SAM|BR|BR012|SABÁRA
Brazil	Salvador, BR	SAM|BR|BR005|SALVADOR
Brazil	Santa Cruz Do Sul, BR	SAM|BR|BR019|SANTA CRUZ DO SUL
Brazil	Santa Luzia, BR	SAM|BR|BR014|SANTA LUZIA
Brazil	Santa Maria, BR	SAM|BR|BR019|SANTA MARIA
Brazil	Santa Rita, BR	SAM|BR|BR014|SANTA RITA
Brazil	Santarem, BR	SAM|BR|BR013|SANTARÉM
Brazil	Santo Andre, BR	SAM|BR|BR023|SANTO ANDRÉ
Brazil	Santos, BR	SAM|BR|BR023|SANTOS
Brazil	Sao Bernardo Do Campo,	SAM|BR|BR023|SAO BERNARDO DO

	BR	CAMPO
Brazil	Sao Caetano Do Sul, BR	SAM|BR|BR023|SAO CAETANO DO SUL
Brazil	Sao Goncalo, BR	SAM|BR|BR014|SAO GONÇALO
Brazil	Sao Joao De Meriti, BR	SAM|BR|BR017|SAO JOAO DE MERITI
Brazil	Sao Jose Do Rio Preto, BR	SAM|BR|BR017|SAO JOSÉ DO RIO PRÊTO
Brazil	Sao Jose Dos Campos, BR	SAM|BR|BR012|SAO JOSÉ DOS CAMPOS
Brazil	Sao Jose Dos Pinhais, BR	SAM|BR|BR015|SAO JOSÉ DOS PINHAIS
Brazil	Sao Leopoldo, BR	SAM|BR|BR019|SAO LEOPOLDO
Brazil	Sao Paulo, BR	SAM|BR|BR023|SAO PAULO
Brazil	Sao Vicente, BR	SAM|BR|BR023|SAO VICENTE
Brazil	Serra, BR	SAM|BR|BR023|SERRA
Brazil	Sertaozinho, BR	SAM|BR|BR023|SERTAOZINHO
Brazil	Sete Lagoas, BR	SAM|BR|BR012|SETE LAGOAS
Brazil	Sobral, BR	SAM|BR|BR006|SOBRAL
Brazil	Sorocaba, BR	SAM|BR|BR023|SOROCABA
Brazil	Sumare, BR	SAM|BR|BR023|SUMARÉ
Brazil	Susano, BR	SAM|BR|BR023|SUSANO
Brazil	Taboao Da Serra, BR	SAM|BR|BR023|TABOAO DA SERRA
Brazil	Taubate, BR	SAM|BR|BR023|TAUBATÉ
Brazil	Teofilo Otoni, BR	SAM|BR|BR012|TEÓFILO OTONI
Brazil	Teresina, BR	SAM|BR|BR016|TERESINA
Brazil	Teresopolis, BR	SAM|BR|BR017|TERESÓPOLIS
Brazil	Timon, BR	SAM|BR|BR009|TIMON
Brazil	Toledo, BR	SAM|BR|BR012|TOLEDO
Brazil	Uberaba, BR	SAM|BR|BR012|UBERABA
Brazil	Uberlandia, BR	SAM|BR|BR012|UBERLÂNDIA
Brazil	Uruguaiana, BR	SAM|BR|BR019|URUGUAIANA
Brazil	Varginha, BR	SAM|BR|BR012|VARGINHA
Brazil	Varzea Grande, BR	SAM|BR|BR010|VARZEA GRANDE
Brazil	Viamao, BR	SAM|BR|BR019|VIAMAO
Brazil	Vila Velha, BR	SAM|BR|BR026|VILA VELHA
Brazil	Vitoria, BR	SAM|BR|BR015|VITÓRIA
Brazil	Vitoria Da Conquista, BR	SAM|BR|BR005|VITÓRIA DA CONQUISTA
Brazil	Vitoria De Santo Antao, BR	SAM|BR|BR026|VITÓRIA DE SANTO ANTAO
Brazil	Volta Redonda, BR	SAM|BR|BR017|VOLTA REDONDA
British Virgin Islands	Road Town, VG	CAC|VG|VI---|ROAD TOWN
Brunei	Bandar Seri Begawan, BN	ASI|BN|BX000|BANDAR SERI BEGAWAN
Bulgaria	Bourgas, BG	EUR|BG|BU002|BOURGAS
Bulgaria	Dobritch, BG	EUR|BG|BU003|DOBRITCH
Bulgaria	Nikopol, BG	EUR|BG|BU012|NIKOPOL
Bulgaria	Plovdiv, BG	EUR|BG|BU013|PLOVDIV

Bulgaria	Rousse, BG	EUR|BG|BU015|ROUSSÉ
Bulgaria	Sofia, BG	EUR|BG|BU021|SOFIA
Bulgaria	Stara Zagora, BG	EUR|BG|BU022|STARA ZAGORA
Bulgaria	Varna, BG	EUR|BG|BU024|VARNA
Burkina Faso	Bobo Dioulasso, BF	AFR|BF|UV000|BOBO DIOULASSO
Burkina Faso	Ouagadougou, BF	AFR|BF|UV010|OUAGADOUGOU
Burma/Myanmar	Bassein, MM	ASI|MM|BM001|BASSEIN
Burma/Myanmar	Mandalay, MM	ASI|MM|BM008|MANDALAY
Burma/Myanmar	Monywa, MM	ASI|MM|BM011|MONYWA
Burma/Myanmar	Moulmein, MM	ASI|MM|BM009|MOULMEIN
Burma/Myanmar	Pegu, MM	ASI|MM|BM002|PEGU
Burma/Myanmar	Sittwe, MM	ASI|MM|BM010|SITTWE
Burma/Myanmar	Taunggyi, MM	ASI|MM|BM012|TAUNGGYI
Burma/Myanmar	Yangon, MM	ASI|MM|BM014|YANGON
Burundi	Bujumbura, BI	AFR|BI|BY000|BUJUMBURA
Cambodia	Bat Dambang, KH	ASI|KH|CB002|BAT DAMBANG
Cambodia	Kampong Cham, KH	ASI|KH|CB003|KAMPONG CHAM
Cambodia	Phnom Penh, KH	ASI|KH|CB012|PHNOM PENH
Cameroon	Bafoussam, CM	AFR|CM|CM008|BAFOUSSAM
Cameroon	Bamenda, CM	AFR|CM|CM007|BAMENDA
Cameroon	Douala, CM	AFR|CM|CM005|DOUALA
Cameroon	Edea, CM	AFR|CM|CM005|EDÉA
Cameroon	Garoua, CM	AFR|CM|CM006|GAROUA
Cameroon	Maroua, CM	AFR|CM|CM004|MAROUA
Cameroon	Ngaoundere, CM	AFR|CM|CM001|NGAOUNDERE
Cameroon	Nkongsamba, CM	AFR|CM|CM005|NKONGSAMBA
Cameroon	Yaounde, CM	AFR|CM|CM002|YAOUNDE
Canada	Abbotsford, CA	NAM|CA|BC|ABBOTSFORD
Canada	Barrie, CA	NAM|CA|ON|BARRIE
Canada	Brampton, CA	NAM|CA|ON|BRAMPTON
Canada	Brantford, CA	NAM|CA|ON|BRANTFORD
Canada	Burlington, CA	NAM|CA|NL|BURLINGTON
Canada	Burnaby, CA	NAM|CA|BC|BURNABY
Canada	Calgary, CA	NAM|CA|AB|CALGARY
Canada	Cambridge, CA	NAM|CA|ON|CAMBRIDGE
Canada	Coquitlam, CA	NAM|CA|BC|COQUITLAM
Canada	East York, CA	NAM|CA|ON|EAST YORK
Canada	Edmonton, CA	NAM|CA|AB|EDMONTON
Canada	Etobicoke, CA	NAM|CA|ON|ETOBICOKE
Canada	Gatineau, CA	NAM|CA|QC|GATINEAU
Canada	Guelph, CA	NAM|CA|ON|GUELPH
Canada	Halifax, CA	NAM|CA|NS|HALIFAX
Canada	Hamilton, CA	NAM|CA|ON|HAMILTON

Canada	Kelowna, CA	NAM|CA|BC|KELOWNA
Canada	Kingston, CA	NAM|CA|ON|KINGSTON
Canada	Kitchener, CA	NAM|CA|ON|KITCHENER
Canada	Laval, CA	NAM|CA|QC|LAVAL
Canada	London, CA	NAM|CA|ON|LONDON
Canada	Longueuil, CA	NAM|CA|QC|LONGUEUIL
Canada	Markham, CA	NAM|CA|ON|MARKHAM
Canada	Mississauga, CA	NAM|CA|ON|MISSISSAUGA
Canada	Moncton, CA	NAM|CA|NB|MONCTON
Canada	Montreal, CA	NAM|CA|QC|MONTRÉAL
Canada	Nepean, CA	NAM|CA|ON|NEPEAN
Canada	North York, CA	NAM|CA|ON|NORTH YORK
Canada	Oakville, CA	NAM|CA|ON|OAKVILLE
Canada	Oshawa, CA	NAM|CA|ON|OSHAWA
Canada	Ottawa, CA	NAM|CA|ON|OTTAWA
Canada	Peterborough, CA	NAM|CA|ON|PETERBOROUGH
Canada	Quebec, CA	NAM|CA|QC|QUÉBEC
Canada	Regina, CA	NAM|CA|SK|REGINA
Canada	Richmond, CA	NAM|CA|BC|RICHMOND
Canada	Richmond Hill, CA	NAM|CA|ON|RICHMOND HILL
Canada	Saint Catharines, CA	NAM|CA|ON|SAINT CATHARINES
Canada	Saint John, CA	NAM|CA|NB|SAINT JOHN
Canada	Saint John'S, CA	NAM|CA|QC|SAINT JOHN'S
Canada	Saskatoon, CA	NAM|CA|SK|SASKATOON
Canada	Scarborough, CA	NAM|CA|ON|SCARBOROUGH
Canada	Sherbrooke, CA	NAM|CA|NS|SHERBROOKE
Canada	Sudbury, CA	NAM|CA|ON|SUDBURY
Canada	Surrey, CA	NAM|CA|PE|SURREY
Canada	Three Rivers, CA	NAM|CA|QC|TROIS-RIVIÈRES
Canada	Thunder Bay, CA	NAM|CA|ON|THUNDER BAY
Canada	Toronto, CA	NAM|CA|ON|TORONTO
Canada	Vancouver, CA	NAM|CA|BC|VANCOUVER
Canada	Vaughan, CA	NAM|CA|AC003|VAUGHAN
Canada	Victoria, CA	NAM|CA|BC|VICTORIA
Canada	Windsor, CA	NAM|CA|NL|WINDSOR
Canada	Winnipeg, CA	NAM|CA|MB|WINNIPEG
Canada	York, CA	NAM|CA|QC|YORK
Cape Verde	Praia, CV	AFR|CV|CV000|PRAIA
Cayman Islands	George Town, KY	CAC|KY|CJ000|GEORGE TOWN
Central African Republic	Bangui, CF	AFR|CF|CT000|BANGUI
Chad	N'Djamena, TD	AFR|TD|CD004|N'DJAMENA
Chile	Antofagasta, CL	SAM|CL|CI002|ANTOFAGASTA

Chile	Arica, CL	SAM|CL|CI012|ARICA
Chile	Calama, CL	SAM|CL|CI002|CALAMA
Chile	Chillan, CL	SAM|CL|CI005|CHILLÁN
Chile	Concepcion, CL	SAM|CL|CI005|CONCEPCIÓN
Chile	Copiapo, CL	SAM|CL|CI004|COPIAPÓ
Chile	Coquimbo, CL	SAM|CL|CI006|COQUIMBO
Chile	Iquique, CL	SAM|CL|CI012|IQUIQUE
Chile	La Serena, CL	SAM|CL|CI006|LA SERENA
Chile	Los Angeles, CL	SAM|CL|CI005|LOS ANGELES
Chile	Osorno, CL	SAM|CL|CI008|OSORNO
Chile	Puente Alto, CL	SAM|CL|CI011|PUENTE ALTO
Chile	Puerto Montt, CL	SAM|CL|CI008|PUERTO MONTT
Chile	Punta Arenas, CL	SAM|CL|CI009|PUNTA ARENAS
Chile	Quilpue, CL	SAM|CL|CI013|QUILPUÉ
Chile	Rancagua, CL	SAM|CL|CI007|RANCAGUA
Chile	San Bernardo, CL	SAM|CL|CI011|SAN BERNARDO
Chile	Santiago, CL	SAM|CL|CI011|SANTIAGO
Chile	Talca, CL	SAM|CL|CI010|TALCA
Chile	Talcahuano, CL	SAM|CL|CI005|TALCAHUANO
Chile	Temuco, CL	SAM|CL|CI003|TEMUCO
Chile	Valdivia, CL	SAM|CL|CI008|VALDIVIA
Chile	Valparaiso, CL	SAM|CL|CI013|VALPARAÍSO
Chile	Vina Del Mar, CL	SAM|CL|CI013|VIÑA DEL MAR
China	Acheng, CN	ASI|CN|CH011|ACHENG
China	Anda, CN	ASI|CN|CH011|ANDA
China	Ankang, CN	ASI|CN|CH022|ANKANG
China	Anlu, CN	ASI|CN|CH013|ANLU
China	Anqing, CN	ASI|CN|CH001|ANQING
China	Anshan, CN	ASI|CN|CH001|ANSHAN
China	Anyang, CN	ASI|CN|CH012|ANYANG
China	Atushi, CN	ASI|CN|CH028|ATUSHI
China	Baicheng, CN	ASI|CN|CH028|BAICHENG
China	Baiyin, CN	ASI|CN|CH001|BAIYIN
China	Baoding, CN	ASI|CN|CH001|BAODING
China	Baoji, CN	ASI|CN|CH018|BAOJI
China	Baoshan, CN	ASI|CN|CH031|BAOSHAN
China	Baotou, CN	ASI|CN|CH019|BAOTOU
China	Bazhou, CN	ASI|CN|CH008|BAZHOU
China	Beian, CN	ASI|CN|CH016|BEIAN
China	Beihai, CN	ASI|CN|CH007|BEIHAI
China	Beijing, CN	ASI|CN|CH002|BEIJING
China	Beipiao, CN	ASI|CN|CH018|BEIPIAO
China	Benxi, CN	ASI|CN|CH018|BENXI

China	Binzhou, CN	ASI|CN|CH023|BINZHOU
China	Cangzhou, CN	ASI|CN|CH004|CANGZHOU
China	Changchun, CN	ASI|CN|CH017|CHANGCHUN
China	Changde, CN	ASI|CN|CH014|CHANGDE
China	Changji, CN	ASI|CN|CH028|CHANGJI
China	Changsha, CN	ASI|CN|CH014|CHANGSHA
China	Changshu, CN	ASI|CN|CH015|CHANGSHU
China	Changzhi, CN	ASI|CN|CH023|CHANGZHI
China	Changzhou, CN	ASI|CN|CH015|CHANGZHOU
China	Chaohu, CN	ASI|CN|CH001|CHAOHU
China	Chaoyang, CN	ASI|CN|CH017|CHAOYANG
China	Chaozhou, CN	ASI|CN|CH006|CHAOZHOU
China	Chengde, CN	ASI|CN|CH010|CHENGDE
China	Chengdu, CN	ASI|CN|CH026|CHENGDU
China	Chenzhou, CN	ASI|CN|CH014|CHENZHOU
China	Chifeng, CN	ASI|CN|CH019|CHIFENG
China	Chongqing, CN	ASI|CN|CH003|CHONGQING
China	Chuxiong, CN	ASI|CN|CH030|CHUXIONG
China	Chuzhou, CN	ASI|CN|CH001|CHUZHOU
China	Cixi, CN	ASI|CN|CH001|CIXI
China	Daan, CN	ASI|CN|CH026|DAAN
China	Dali, CN	ASI|CN|CH030|DALI
China	Dalian, CN	ASI|CN|CH018|DALIAN
China	Dandong, CN	ASI|CN|CH018|DANDONG
China	Dangyang, CN	ASI|CN|CH013|DANGYANG
China	Danjiangkou, CN	ASI|CN|CH013|DANJIANGKOU
China	Danyang, CN	ASI|CN|CH015|DANYANG
China	Daqing, CN	ASI|CN|CH011|DAQING
China	Datong, CN	ASI|CN|CH001|DATONG
China	Daxian, CN	ASI|CN|CH026|DAXIAN
China	Dengzhou, CN	ASI|CN|CH023|DENGZHOU
China	Deyang, CN	ASI|CN|CH026|DEYANG
China	Dezhou, CN	ASI|CN|CH023|DEZHOU
China	Dingzhou, CN	ASI|CN|CH010|DINGZHOU
China	Dongchuan, CN	ASI|CN|CH030|DONGCHUAN
China	Dongguan, CN	ASI|CN|CH016|DONGGUAN
China	Dongsheng, CN	ASI|CN|CH019|DONGSHENG
China	Dongtai, CN	ASI|CN|CH015|DONGTAI
China	Dongyang, CN	ASI|CN|CH011|DONGYANG
China	Dongying, CN	ASI|CN|CH019|DONGYING
China	Dujun, CN	ASI|CN|CH016|DUJUN
China	Dunhua, CN	ASI|CN|CH017|DUNHUA
China	Dunhuang, CN	ASI|CN|CH005|DUNHUANG

China	Enshi, CN	ASI|CN|CH013|ENSHI
China	Fengcheng, CN	ASI|CN|CH016|FENGCHENG
China	Fenghua, CN	ASI|CN|CH031|FENGHUA
China	Foshan, CN	ASI|CN|CH006|FOSHAN
China	Fuan, CN	ASI|CN|CH004|FUAN
China	Fujin, CN	ASI|CN|CH011|FUJIN
China	Fulin, CN	ASI|CN|CH014|FULIN
China	Fushun, CN	ASI|CN|CH018|FUSHUN
China	Fuxin, CN	ASI|CN|CH018|FUXIN
China	Fuyang, CN	ASI|CN|CH001|FUYANG
China	Fuyu, CN	ASI|CN|CH011|FUYU
China	Fuzhou, CN	ASI|CN|CH004|FUZHOU
China	Ganzhou, CN	ASI|CN|CH016|GANZHOU
China	Gaocheng, CN	ASI|CN|CH013|GAOCHENG
China	Gejiu, CN	ASI|CN|CH030|GEJIU
China	Gongzhuling, CN	ASI|CN|CH017|GONGZHULING
China	Guanghan, CN	ASI|CN|CH001|GUANGHAN
China	Guangshui, CN	ASI|CN|CH013|GUANGSHUI
China	Guangyuan, CN	ASI|CN|CH026|GUANGYUAN
China	Guangzhou, CN	ASI|CN|CH006|GUANGZHOU
China	Guichi, CN	ASI|CN|CH001|GUICHI
China	Guilin, CN	ASI|CN|CH016|GUILIN
China	Guiyang, CN	ASI|CN|CH007|GUIYANG
China	Haicheng, CN	ASI|CN|CH004|HAICHENG
China	Haikou, CN	ASI|CN|CH009|HAIKOU
China	Haining, CN	ASI|CN|CH031|HAINING
China	Hami, CN	ASI|CN|CH028|HAMI
China	Hancheng, CN	ASI|CN|CH022|HANCHENG
China	Handan, CN	ASI|CN|CH016|HANDAN
China	Hangzhou, CN	ASI|CN|CH031|HANGZHOU
China	Hanzhong, CN	ASI|CN|CH022|HANZHONG
China	Harbin, CN	ASI|CN|CH011|HARBIN
China	Hebi, CN	ASI|CN|CH012|HEBI
China	Hechi, CN	ASI|CN|CH007|HECHI
China	Hefei, CN	ASI|CN|CH001|HEFEI
China	Hegang, CN	ASI|CN|CH001|HEGANG
China	Heihe, CN	ASI|CN|CH011|HEIHE
China	Hengshui, CN	ASI|CN|CH010|HENGSHUI
China	Hengyang, CN	ASI|CN|CH014|HENGYANG
China	Heshan, CN	ASI|CN|CH006|HESHAN
China	Hetian, CN	ASI|CN|CH004|HETIAN
China	Heyuan, CN	ASI|CN|CH006|HEYUAN
China	Heze, CN	ASI|CN|CH023|HEZE

China	Hohhot, CN	ASI|CN|CH019|HOHHOT
China	Honghu, CN	ASI|CN|CH009|HONGHU
China	Houma, CN	ASI|CN|CH025|HOUMA
China	Huadian, CN	ASI|CN|CH017|HUADIAN
China	Huaian, CN	ASI|CN|CH025|HUAIAN
China	Huaibei, CN	ASI|CN|CH001|HUAIBEI
China	Huaihua, CN	ASI|CN|CH014|HUAIHUA
China	Huainan, CN	ASI|CN|CH004|HUAINAN
China	Huaiyin, CN	ASI|CN|CH015|HUAIYIN
China	Huanghua, CN	ASI|CN|CH010|HUANGHUA
China	Huangshan, CN	ASI|CN|CH023|HUANGSHAN
China	Huangshi, CN	ASI|CN|CH001|HUANGSHI
China	Huaying, CN	ASI|CN|CH026|HUAYING
China	Huixian, CN	ASI|CN|CH005|HUIXIAN
China	Huizhou, CN	ASI|CN|CH006|HUIZHOU
China	Huludao, CN	ASI|CN|CH018|HULUDAO
China	Hunjiang, CN	ASI|CN|CH017|HUNJIANG
China	Huzhou, CN	ASI|CN|CH031|HUZHOU
China	Jiageda, CN	ASI|CN|CH019|JIAGEDA
China	Jiamusi, CN	ASI|CN|CH011|JIAMUSI
China	Jian, CN	ASI|CN|CH016|JIAN
China	Jiangmen, CN	ASI|CN|CH006|JIANGMEN
China	Jiangshan, CN	ASI|CN|CH001|JIANGSHAN
China	Jiangyin, CN	ASI|CN|CH004|JIANGYIN
China	Jiangyou, CN	ASI|CN|CH026|JIANGYOU
China	Jiaojiang, CN	ASI|CN|CH031|JIAOJIANG
China	Jiaozhou, CN	ASI|CN|CH023|JIAOZHOU
China	Jiaozuo, CN	ASI|CN|CH012|JIAOZUO
China	Jiaxing, CN	ASI|CN|CH031|JIAXING
China	Jieshou, CN	ASI|CN|CH001|JIESHOU
China	Jilin, CN	ASI|CN|CH007|JILIN
China	Jimo, CN	ASI|CN|CH023|JIMO
China	Jinan, CN	ASI|CN|CH007|JINAN
China	Jinchang, CN	ASI|CN|CH005|JINCHANG
China	Jingdezhen, CN	ASI|CN|CH016|JINGDEZHEN
China	Jingmen, CN	ASI|CN|CH004|JINGMEN
China	Jingzhou, CN	ASI|CN|CH013|JINGZHOU
China	Jinhua, CN	ASI|CN|CH008|JINHUA
China	Jining, CN	ASI|CN|CH019|JINING
China	Jinshi, CN	ASI|CN|CH031|JINSHI
China	Jinxi, CN	ASI|CN|CH016|JINXI
China	Jinzhou, CN	ASI|CN|CH018|JINZHOU
China	Jishou, CN	ASI|CN|CH014|JISHOU

China	Jiujiang, CN	ASI|CN|CH016|JIUJIANG
China	Jiuquan, CN	ASI|CN|CH005|JIUQUAN
China	Jiutai, CN	ASI|CN|CH008|JIUTAI
China	Jixi, CN	ASI|CN|CH001|JIXI
China	Jiyuan, CN	ASI|CN|CH012|JIYUAN
China	Kaifeng, CN	ASI|CN|CH012|KAIFENG
China	Kaili, CN	ASI|CN|CH008|KAILI
China	Kaiyuan, CN	ASI|CN|CH018|KAIYUAN
China	Kashi, CN	ASI|CN|CH028|KASHI
China	Kelamayi, CN	ASI|CN|CH028|KELAMAYI
China	Kunming, CN	ASI|CN|CH030|KUNMING
China	Kunshan, CN	ASI|CN|CH001|KUNSHAN
China	Laiwu, CN	ASI|CN|CH016|LAIWU
China	Laiyang, CN	ASI|CN|CH023|LAIYANG
China	Laizhou, CN	ASI|CN|CH004|LAIZHOU
China	Langfang, CN	ASI|CN|CH010|LANGFANG
China	Lanxi, CN	ASI|CN|CH001|LANXI
China	Lanzhou, CN	ASI|CN|CH005|LANZHOU
China	Laohekou, CN	ASI|CN|CH013|LAOHEKOU
China	Leiyang, CN	ASI|CN|CH014|LEIYANG
China	Leling, CN	ASI|CN|CH023|LELING
China	Lengshuijiang, CN	ASI|CN|CH014|LENGSHUIJIANG
China	Lengshuitan, CN	ASI|CN|CH014|LENGSHUITAN
China	Leshan, CN	ASI|CN|CH026|LESHAN
China	Lhasa, CN	ASI|CN|CH029|LHASA
China	Lianyuan, CN	ASI|CN|CH014|LIANYUAN
China	LianYunGang, CN	ASI|CN|CH015|LIANYUNGANG
China	Liaocheng, CN	ASI|CN|CH023|LIAOCHENG
China	Liaoyang, CN	ASI|CN|CH018|LIAOYANG
China	Linyi, CN	ASI|CN|CH023|LINYI
China	Lishui, CN	ASI|CN|CH031|LISHUI
China	Liuzhou, CN	ASI|CN|CH007|LIUZHOU
China	Luoyang, CN	ASI|CN|CH012|LUOYANG
China	Maanshan, CN	ASI|CN|CH026|MAANSHAN
China	Macheng, CN	ASI|CN|CH001|MACHENG
China	Maoming, CN	ASI|CN|CH006|MAOMING
China	Meihekou, CN	ASI|CN|CH017|MEIHEKOU
China	Meixian, CN	ASI|CN|CH004|MEIXIAN
China	Mianyang, CN	ASI|CN|CH004|MIANYANG
China	Miluo, CN	ASI|CN|CH014|MILUO
China	Mishan, CN	ASI|CN|CH011|MISHAN
China	Mudanjiang, CN	ASI|CN|CH011|MUDANJIANG
China	Nanchang, CN	ASI|CN|CH016|NANCHANG

China	Nanchong, CN	ASI|CN|CH026|NANCHONG
China	Nangong, CN	ASI|CN|CH010|NANGONG
China	Nanjing, CN	ASI|CN|CH016|NANJING
China	Nanning, CN	ASI|CN|CH007|NANNING
China	Nanping, CN	ASI|CN|CH004|NANPING
China	Nantong, CN	ASI|CN|CH015|NANTONG
China	Nanyang, CN	ASI|CN|CH004|NANYANG
China	Neijiang, CN	ASI|CN|CH026|NEIJIANG
China	Ningbo, CN	ASI|CN|CH031|NINGBO
China	Ningde, CN	ASI|CN|CH004|NINGDE
China	Panjin, CN	ASI|CN|CH018|PANJIN
China	Panzhihua, CN	ASI|CN|CH026|PANZHIHUA
China	Pingdingshan, CN	ASI|CN|CH012|PINGDINGSHAN
China	Pingdu, CN	ASI|CN|CH016|PINGDU
China	Pingliang, CN	ASI|CN|CH005|PINGLIANG
China	Puqi, CN	ASI|CN|CH013|PUQI
China	Putian, CN	ASI|CN|CH004|PUTIAN
China	Puyang, CN	ASI|CN|CH012|PUYANG
China	Qianjiang, CN	ASI|CN|CH007|QIANJIANG
China	Qidong, CN	ASI|CN|CH014|QIDONG
China	Qingdao, CN	ASI|CN|CH023|QINGDAO
China	Qingtongxia, CN	ASI|CN|CH020|QINGTONGXIA
China	Qingyuan, CN	ASI|CN|CH018|QINGYUAN
China	Qingzhou, CN	ASI|CN|CH004|QINGZHOU
China	Qinhuangdao, CN	ASI|CN|CH010|QINHUANGDAO
China	Qinyang, CN	ASI|CN|CH012|QINYANG
China	Qinzhou, CN	ASI|CN|CH007|QINZHOU
China	Qiqihar, CN	ASI|CN|CH011|QIQIHAR
China	Qitaihe, CN	ASI|CN|CH011|QITAIHE
China	Quanzhou, CN	ASI|CN|CH004|QUANZHOU
China	Qufu, CN	ASI|CN|CH023|QUFU
China	Qujing, CN	ASI|CN|CH030|QUJING
China	Quzhou, CN	ASI|CN|CH010|QUZHOU
China	Renqiu, CN	ASI|CN|CH010|RENQIU
China	Rizhao, CN	ASI|CN|CH023|RIZHAO
China	Rongcheng, CN	ASI|CN|CH010|RONGCHENG
China	Ruian, CN	ASI|CN|CH004|RUIAN
China	Ruichang, CN	ASI|CN|CH016|RUICHANG
China	Ruzhou, CN	ASI|CN|CH004|RUZHOU
China	Sanmenxia, CN	ASI|CN|CH012|SANMENXIA
China	Sanming, CN	ASI|CN|CH004|SANMING
China	Sanya, CN	ASI|CN|CH009|SANYA
China	Shahe, CN	ASI|CN|CH001|SHAHE

China	Shanghai, CN	ASI|CN|CH024|SHANGHAI
China	Shangluo, CN	ASI|CN|CH022|SHANGLUO
China	Shangqiu, CN	ASI|CN|CH012|SHANGQIU
China	Shangrao, CN	ASI|CN|CH016|SHANGRAO
China	Shangzhi, CN	ASI|CN|CH011|SHANGZHI
China	Shangzhou, CN	ASI|CN|CH026|SHANGZHOU
China	Shantou, CN	ASI|CN|CH006|SHANTOU
China	Shanwei, CN	ASI|CN|CH004|SHANWEI
China	Shaoguan, CN	ASI|CN|CH006|SHAOGUAN
China	Shaowu, CN	ASI|CN|CH004|SHAOWU
China	Shaoxing, CN	ASI|CN|CH031|SHAOXING
China	Shaoyang, CN	ASI|CN|CH014|SHAOYANG
China	Shashi, CN	ASI|CN|CH001|SHASHI
China	Shenyang, CN	ASI|CN|CH018|SHENYANG
China	Shenzhen, CN	ASI|CN|CH031|SHENZHEN
China	Shihezi, CN	ASI|CN|CH028|SHIHEZI
China	Shijiazhuang, CN	ASI|CN|CH010|SHIJIAZHUANG
China	Shishi, CN	ASI|CN|CH004|SHISHI
China	Shishou, CN	ASI|CN|CH013|SHISHOU
China	Shiyan, CN	ASI|CN|CH013|SHIYAN
China	Shizuishan, CN	ASI|CN|CH020|SHIZUISHAN
China	Shuangcheng, CN	ASI|CN|CH011|SHUANGCHENG
China	Suihua, CN	ASI|CN|CH011|SUIHUA
China	Suining, CN	ASI|CN|CH014|SUINING
China	Suizhou, CN	ASI|CN|CH013|SUIZHOU
China	Suqian, CN	ASI|CN|CH015|SUQIAN
China	Suzhou, CN	ASI|CN|CH015|SUZHOU
China	Tacheng, CN	ASI|CN|CH028|TACHENG
China	Taian, CN	ASI|CN|CH018|TAIAN
China	Taiyuan, CN	ASI|CN|CH025|TAIYUAN
China	Taizhou, CN	ASI|CN|CH015|TAIZHOU
China	Taizhou, CN	ASI|CN|CH015|TAIZHOU
China	Tangshan, CN	ASI|CN|CH010|TANGSHAN
China	Taonan, CN	ASI|CN|CH017|TAONAN
China	Tengzhou, CN	ASI|CN|CH023|TENGZHOU
China	Tianjin, CN	ASI|CN|CH027|TIANJIN
China	Tianmen, CN	ASI|CN|CH011|TIANMEN
China	Tianshui, CN	ASI|CN|CH005|TIANSHUI
China	Tiefa, CN	ASI|CN|CH018|TIEFA
China	Tieli, CN	ASI|CN|CH011|TIELI
China	Tieling, CN	ASI|CN|CH018|TIELING
China	Tongchuan, CN	ASI|CN|CH022|TONGCHUAN
China	Tonghua, CN	ASI|CN|CH017|TONGHUA

China	Tongjiang, CN	ASI|CN|CH011|TONGJIANG
China	Tongliao, CN	ASI|CN|CH019|TONGLIAO
China	Tongling, CN	ASI|CN|CH001|TONGLING
China	Tongren, CN	ASI|CN|CH008|TONGREN
China	Tulufan, CN	ASI|CN|CH028|TULUFAN
China	Tumen, CN	ASI|CN|CH017|TUMEN
China	Wafangdian, CN	ASI|CN|CH022|WAFANGDIAN
China	Wanxian, CN	ASI|CN|CH003|WANXIAN
China	Weifang, CN	ASI|CN|CH023|WEIFANG
China	Weihai, CN	ASI|CN|CH023|WEIHAI
China	Weihui, CN	ASI|CN|CH012|WEIHUI
China	Weinan, CN	ASI|CN|CH022|WEINAN
China	Wendeng, CN	ASI|CN|CH023|WENDENG
China	Wenzhou, CN	ASI|CN|CH031|WENZHOU
China	Wuan, CN	ASI|CN|CH014|WUAN
China	Wugang, CN	ASI|CN|CH014|WUGANG
China	Wuhai, CN	ASI|CN|CH019|WUHAI
China	Wuhan, CN	ASI|CN|CH013|WUHAN
China	Wuhu, CN	ASI|CN|CH001|WUHU
China	Wulumuqi, CN	ASI|CN|CH028|WULUMUQI
China	Wuxi, CN	ASI|CN|CH003|WUXI
China	Wuxue, CN	ASI|CN|CH013|WUXUE
China	Wuyishan, CN	ASI|CN|CH004|WUYISHAN
China	Wuzhong, CN	ASI|CN|CH020|WUZHONG
China	Wuzhou, CN	ASI|CN|CH007|WUZHOU
China	Xiamen, CN	ASI|CN|CH004|XIAMEN
China	Xian, CN	ASI|CN|CH010|XIAN
China	Xiangfan, CN	ASI|CN|CH013|XIANGFAN
China	Xiangtan, CN	ASI|CN|CH026|XIANGTAN
China	Xiangxiang, CN	ASI|CN|CH014|XIANGXIANG
China	Xianning, CN	ASI|CN|CH013|XIANNING
China	Xiantao, CN	ASI|CN|CH013|XIANTAO
China	Xianyang, CN	ASI|CN|CH004|XIANYANG
China	Xiaogan, CN	ASI|CN|CH013|XIAOGAN
China	Xiaoshan, CN	ASI|CN|CH031|XIAOSHAN
China	Xichang, CN	ASI|CN|CH026|XICHANG
China	Xifeng, CN	ASI|CN|CH023|XIFENG
China	Xingcheng, CN	ASI|CN|CH025|XINGCHENG
China	Xinghua, CN	ASI|CN|CH015|XINGHUA
China	Xingtai, CN	ASI|CN|CH010|XINGTAI
China	Xingyi, CN	ASI|CN|CH008|XINGYI
China	Xining, CN	ASI|CN|CH021|XINING
China	Xinji, CN	ASI|CN|CH010|XINJI

China	Xintai, CN	ASI|CN|CH008|XINTAI
China	Xinxiang, CN	ASI|CN|CH012|XINXIANG
China	Xinyang, CN	ASI|CN|CH012|XINYANG
China	Xinyi, CN	ASI|CN|CH006|XINYI
China	Xinyu, CN	ASI|CN|CH012|XINYU
China	Xinzhou, CN	ASI|CN|CH001|XINZHOU
China	Xuchang, CN	ASI|CN|CH001|XUCHANG
China	Xuzhou, CN	ASI|CN|CH015|XUZHOU
China	Yaan, CN	ASI|CN|CH026|YAAN
China	Yakeshi, CN	ASI|CN|CH019|YAKESHI
China	Yanan, CN	ASI|CN|CH022|YANAN
China	Yancheng, CN	ASI|CN|CH023|YANCHENG
China	Yangjiang, CN	ASI|CN|CH006|YANGJIANG
China	Yangquan, CN	ASI|CN|CH025|YANGQUAN
China	Yangzhou, CN	ASI|CN|CH015|YANGZHOU
China	Yanji, CN	ASI|CN|CH012|YANJI
China	Yantai, CN	ASI|CN|CH023|YANTAI
China	Yibin, CN	ASI|CN|CH026|YIBIN
China	Yichang, CN	ASI|CN|CH013|YICHANG
China	Yichun, CN	ASI|CN|CH011|YICHUN
China	Yinchuan, CN	ASI|CN|CH020|YINCHUAN
China	Yingcheng, CN	ASI|CN|CH013|YINGCHENG
China	Yingkou, CN	ASI|CN|CH018|YINGKOU
China	Yingtan, CN	ASI|CN|CH016|YINGTAN
China	Yining, CN	ASI|CN|CH016|YINING
China	Yiwu, CN	ASI|CN|CH028|YIWU
China	Yixing, CN	ASI|CN|CH015|YIXING
China	Yiyang, CN	ASI|CN|CH012|YIYANG
China	Yizhou, CN	ASI|CN|CH010|YIZHOU
China	Yongan, CN	ASI|CN|CH025|YONGAN
China	Yongzhou, CN	ASI|CN|CH014|YONGZHOU
China	Yuanjiang, CN	ASI|CN|CH030|YUANJIANG
China	Yuci, CN	ASI|CN|CH025|YUCI
China	Yueyang, CN	ASI|CN|CH014|YUEYANG
China	Yulin, Guangxi, CN	ASI|CN|CH007|YULIN
China	Yulin, Shaanxi, CN	ASI|CN|CH022|YULIN
China	Yumen, CN	ASI|CN|CH005|YUMEN
China	Yuncheng, CN	ASI|CN|CH025|YUNCHENG
China	Yutian, CN	ASI|CN|CH010|YUTIAN
China	Yuxi, CN	ASI|CN|CH004|YUXI
China	Yuyao, CN	ASI|CN|CH004|YUYAO
China	Yuzhou, CN	ASI|CN|CH012|YUZHOU
China	Zaozhuang, CN	ASI|CN|CH023|ZAOZHUANG

China	Zhalantun, CN	ASI|CN|CH019|ZHALANTUN
China	Zhangjiagang, CN	ASI|CN|CH015|ZHANGJIAGANG
China	Zhangjiakou, CN	ASI|CN|CH010|ZHANGJIAKOU
China	Zhangshu, CN	ASI|CN|CH015|ZHANGSHU
China	Zhangye, CN	ASI|CN|CH005|ZHANGYE
China	Zhangzhou, CN	ASI|CN|CH004|ZHANGZHOU
China	Zhanjiang, CN	ASI|CN|CH006|ZHANJIANG
China	Zhaodong, CN	ASI|CN|CH011|ZHAODONG
China	Zhaoqing, CN	ASI|CN|CH006|ZHAOQING
China	Zhaotong, CN	ASI|CN|CH030|ZHAOTONG
China	Zhaoyang, CN	ASI|CN|CH015|ZHAOYANG
China	Zhengzhou, CN	ASI|CN|CH012|ZHENGZHOU
China	Zhenjiang, CN	ASI|CN|CH015|ZHENJIANG
China	Zhicheng, CN	ASI|CN|CH031|ZHICHENG
China	Zhongshan, CN	ASI|CN|CH004|ZHONGSHAN
China	Zhoushan, CN	ASI|CN|CH031|ZHOUSHAN
China	Zhucheng, CN	ASI|CN|CH015|ZHUCHENG
China	Zhuhai, CN	ASI|CN|CH006|ZHUHAI
China	Zhuji, CN	ASI|CN|CH023|ZHUJI
China	Zhumadian, CN	ASI|CN|CH012|ZHUMADIAN
China	Zhuozhou, CN	ASI|CN|CH010|ZHUOZHOU
China	Zhuzhou, CN	ASI|CN|CH014|ZHUZHOU
China	Zibo, CN	ASI|CN|CH023|ZIBO
China	Zigong, CN	ASI|CN|CH026|ZIGONG
China	Zixing, CN	ASI|CN|CH014|ZIXING
China	Zunyi, CN	ASI|CN|CH008|ZUNYI
Colombia	Armenia, CO	SAM|CO|CO021|ARMENIA
Colombia	Barrancabermeja, CO	SAM|CO|CO024|BARRANCABERMEJA
Colombia	Barranquilla, CO	SAM|CO|CO004|BARRANQUILLA
Colombia	Bello, CO	SAM|CO|CO002|BELLO
Colombia	Bucaramanga, CO	SAM|CO|CO024|BUCARAMANGA
Colombia	Buenaventura, CO	SAM|CO|CO027|BUENAVENTURA
Colombia	Buga, CO	SAM|CO|CO027|BUGA
Colombia	Cali, CO	SAM|CO|CO027|CALI
Colombia	Cartagena, CO	SAM|CO|CO008|CARTAGENA
Colombia	Cartago, CO	SAM|CO|CO027|CARTAGO
Colombia	Cucuta, CO	SAM|CO|CO005|CUCUTA
Colombia	Dos Quebradas, CO	SAM|CO|CO027|DOS QUEBRADAS
Colombia	Envigado, CO	SAM|CO|CO002|ENVIGADO
Colombia	Florencia, CO	SAM|CO|CO005|FLORENCIA
Colombia	Floridablanca, CO	SAM|CO|CO024|FLORIDABLANCA
Colombia	Girardot, CO	SAM|CO|CO011|GIRARDOT
Colombia	Ibague, CO	SAM|CO|CO026|IBAGUÉ

Colombia	Itagui, CO	SAM|CO|CO002|ITAGÜÍ
Colombia	Maicao, CO	SAM|CO|CO016|MAICAO
Colombia	Manizales, CO	SAM|CO|CO002|MANIZALES
Colombia	Medellin, CO	SAM|CO|CO002|MEDELLÍN
Colombia	Monteria, CO	SAM|CO|CO010|MONTERIA
Colombia	Neiva, CO	SAM|CO|CO015|NEIVA
Colombia	Palmira, CO	SAM|CO|CO027|PALMIRA
Colombia	Pasto, CO	SAM|CO|CO018|PASTO
Colombia	Pereira, CO	SAM|CO|CO022|PEREIRA
Colombia	Popayan, CO	SAM|CO|CO007|POPAYAN
Colombia	Santa Fe De Bogota, CO	SAM|CO|CO000|SANTA FE DE BOGOTA
Colombia	Santa Marta, CO	SAM|CO|CO018|SANTA MARTA
Colombia	Sincelejo, CO	SAM|CO|CO025|SINCELEJO
Colombia	Soacha, CO	SAM|CO|CO011|SOACHA
Colombia	Sogamoso, CO	SAM|CO|CO000|SOGAMOSO
Colombia	Soledad, CO	SAM|CO|CO004|SOLEDAD
Colombia	Tulua, CO	SAM|CO|CO027|TULUA
Colombia	Tunja, CO	SAM|CO|CO019|TUNJA
Colombia	Valledupar, CO	SAM|CO|CO008|VALLEDUPAR
Colombia	Villavicencio, CO	SAM|CO|CO017|VILLAVICENCIO
Comoros	Moroni, KM	AFR|KM|CN004|MORONI
Cook Islands	Rarotonga, CK	OCN|CK|CW---|RAROTONGA
Costa Rica	Alajuela, CR	CAC|CR|CS001|ALAJUELA
Costa Rica	Cartago, CR	CAC|CR|CS002|CARTAGO
Costa Rica	San Jose, CR	CAC|CR|CS007|SAN JOSE
Croatia	Osijek, HR	EUR|HR|HR011|OSIJEK
Croatia	Rijeka, HR	EUR|HR|HR013|RIJEKA
Croatia	Split, HR	EUR|HR|HR016|SPLIT
Croatia	Zagreb, HR	EUR|HR|HR004|ZAGREB
Cuba	Bayamo, CU	CAC|CU|CU005|BAYAMO
Cuba	Camaguey, CU	CAC|CU|CU001|CAMAGÜEY
Cuba	Cienfuegos, CU	CAC|CU|CU003|CIENFUEGOS
Cuba	Guantanamo, CU	CAC|CU|CU006|GUANTÁNAMO
Cuba	Holguin, CU	CAC|CU|CU007|HOLGUÍN
Cuba	La Habana, CU	CAC|CU|CU004|LA HABANA
Cuba	Las Tunas, CU	CAC|CU|CU010|LAS TUNAS
Cuba	Matanzas, CU	CAC|CU|CU011|MATANZAS
Cuba	Pinar Del Rio, CU	CAC|CU|CU012|PINAR DEL RÍO
Cuba	Sancti Spiritus, CU	CAC|CU|CU013|SANCTI SPÍRITUS
Cuba	Santa Clara, CU	CAC|CU|CU015|SANTA CLARA
Cuba	Santiago De Cuba, CU	CAC|CU|CU014|SANTIAGO DE CUBA
Cyprus	Limassol, CY	MEA|CY|CY004|LIMASSOL
Cyprus	Nicosia, CY	MEA|CY|CY005|NICOSIA

Czech Republic	Brno, CZ	EUR|CZ|EZ007|BRNO
Czech Republic	Olomouc, CZ	EUR|CZ|EZ004|OLOMOUC
Czech Republic	Ostrava, CZ	EUR|CZ|EZ004|OSTRAVA
Czech Republic	Plzen, CZ	EUR|CZ|EZ008|PLZEN
Czech Republic	Praha, CZ	EUR|CZ|EZ001|PRAHA
Democratic Republic of Congo	Kinshasa, CD	AFR|CD|CG007|KINSHASA
Denmark	Aalborg, DK	EUR|DK|DA007|AALBORG
Denmark	Aarhus, DK	EUR|DK|DA001|AARHUS
Denmark	Copenhagen, DK	EUR|DK|DA012|COPENHAGEN
Denmark	Esbjerg, DK	EUR|DK|DA008|ESBJERG
Denmark	Fredericia, DK	EUR|DK|DA014|FREDERICIA
Denmark	Frederikshavn, DK	EUR|DK|DA007|FREDERIKSHAVN
Denmark	Hadserslev, DK	EUR|DK|DA011|HADSERSLEV
Denmark	Helsingoer, DK	EUR|DK|DA004|HELSINGOER
Denmark	Herning, DK	EUR|DK|DA009|HERNING
Denmark	Hilleroed, DK	EUR|DK|DA004|HILLEROED
Denmark	Hjoerring, DK	EUR|DK|DA007|HJOERRING
Denmark	Hoersholm, DK	EUR|DK|DA004|HOERSHOLM
Denmark	Holbaek, DK	EUR|DK|DA015|HOLBAEK
Denmark	Holstebro, DK	EUR|DK|DA009|HOLSTEBRO
Denmark	Horsens, DK	EUR|DK|DA014|HORSENS
Denmark	Koege, DK	EUR|DK|DA010|KOEGE
Denmark	Kolding, DK	EUR|DK|DA014|KOLDING
Denmark	Naestved, DK	EUR|DK|DA013|NAESTVED
Denmark	Odense, DK	EUR|DK|DA005|ODENSE
Denmark	Randers, DK	EUR|DK|DA001|RANDERS
Denmark	Roskilde, DK	EUR|DK|DA010|ROSKILDE
Denmark	Silkeborg, DK	EUR|DK|DA001|SILKEBORG
Denmark	Skive, DK	EUR|DK|DA016|SKIVE
Denmark	Slagelse, DK	EUR|DK|DA015|SLAGELSE
Denmark	Soenderborg, DK	EUR|DK|DA011|SOENDERBORG
Denmark	Svendborg, DK	EUR|DK|DA005|SVENDBORG
Denmark	Taastrup, DK	EUR|DK|DA006|TAASTRUP
Denmark	Vejle, DK	EUR|DK|DA014|VEJLE
Denmark	Viborg, DK	EUR|DK|DA005|VIBORG
Djibouti	Djibouti, DJ	AFR|DJ|DJ003|DJIBOUTI
Dominica	Roseau, DM	CAC|DM|DO003|ROSEAU
Dominican Republic	San Pedro De Macoris, DO	CAC|DO|DR026|SAN PEDRO DE MACORIS
Dominican Republic	Santiago De Los Caballeros, DO	CAC|DO|DR028|SANTIAGO DE LOS CABALLEROS

Dominican Republic	Santo Domingo, DO	CAC|DO|DR005|SANTO DOMINGO
East Timor	Dili, TL	ASI|TL|TT000|DILI
Ecuador	Ambato, EC	SAM|EC|EC018|AMBATO
Ecuador	Cuenca, EC	SAM|EC|EC001|CUENCA
Ecuador	Esmeraldas, EC	SAM|EC|EC008|ESMERALDAS
Ecuador	Guayaquil, EC	SAM|EC|EC010|GUAYAQUIL
Ecuador	Ibarra, EC	SAM|EC|EC011|IBARRA
Ecuador	Loja, EC	SAM|EC|EC012|LOJA
Ecuador	Machala, EC	SAM|EC|EC007|MACHALA
Ecuador	Manta, EC	SAM|EC|EC014|MANTA
Ecuador	Milagro, EC	SAM|EC|EC010|MILAGRO
Ecuador	Portoviejo, EC	SAM|EC|EC014|PORTOVIEJO
Ecuador	Quevedo, EC	SAM|EC|EC013|QUEVEDO
Ecuador	Quito, EC	SAM|EC|EC017|QUITO
Ecuador	Riobamba, EC	SAM|EC|EC005|RIOBAMBA
Ecuador	Santo Domingo De Los Colorados, EC	SAM|EC|EC017|SANTO DOMINGO DE LOS COLORADOS
Egypt	Alexandria, EG	AFR|EG|EG006|ALEXANDRIA
Egypt	Aswan, EG	AFR|EG|EG016|ASWAN
Egypt	Banha, EG	AFR|EG|EG012|BANHA
Egypt	Cairo, EG	AFR|EG|EG011|CAIRO
Egypt	Damanhur, EG	AFR|EG|EG003|DAMANHÛR
Egypt	El-Mahalla El-Kubra, EG	AFR|EG|EG005|EL-MAHALLA EL-KUBRA
Egypt	Faiyum, EG	AFR|EG|EG004|FAIYÛM
Egypt	Giza, EG	AFR|EG|EG008|GIZA
Egypt	Imbaba, EG	AFR|EG|EG008|IMBABA
Egypt	Ismailia, EG	AFR|EG|EG007|ISMAILIA
Egypt	Kena, EG	AFR|EG|EG024|KENA
Egypt	Mansura, EG	AFR|EG|EG001|MANSÛRA
Egypt	Menia, EG	AFR|EG|EG010|MENIA
Egypt	Port Said, EG	AFR|EG|EG019|PORT SAID
Egypt	Sohag, EG	AFR|EG|EG023|SOHAG
Egypt	Suez, EG	AFR|EG|EG014|SUEZ
Egypt	Tanta, EG	AFR|EG|EG005|TANTA
Egypt	Zagazig, EG	AFR|EG|EG015|ZAGAZIG
El Salvador	Ahuachapan, SV	CAC|SV|ES001|AHUACHAPAN
El Salvador	Apopa, SV	CAC|SV|ES010|APOPA
El Salvador	Ilopango, SV	CAC|SV|ES010|ILOPANGO
El Salvador	Mejicanos, SV	CAC|SV|ES010|MEJICANOS
El Salvador	Nueva San Salvador, SV	CAC|SV|ES005|NUEVA SAN SALVADOR
El Salvador	San Martin, SV	CAC|SV|ES010|SAN MARTIN
El Salvador	San Miguel, SV	CAC|SV|ES010|SAN MIGUEL

El Salvador	San Salvador, SV	CAC|SV|ES010|SAN SALVADOR
El Salvador	Santa Ana, SV	CAC|SV|ES012|SANTA ANA
El Salvador	Soyapango, SV	CAC|SV|ES010|SOYAPANGO
Equatorial Guinea	Malabo, GQ	AFR|GQ|EK000|MALABO
Eritrea	Asmara, ER	AFR|ER|ER000|ASMARA
Estonia	Tallinn, EE	EUR|EE|EN001|TALLINN
Estonia	Tartu, EE	EUR|EE|EN012|TARTU
Ethiopia	Addis Ababa, ET	AFR|ET|ET000|ADDIS ABABA
Ethiopia	Bahir Dar, ET	AFR|ET|ET000|BAHIR DAR
Ethiopia	Dessie, ET	AFR|ET|ET000|DESSIE
Ethiopia	Dire Dawa, ET	AFR|ET|ET000|DIRE DAWA
Ethiopia	Gondar, ET	AFR|ET|ET000|GONDAR
Ethiopia	Jimma, ET	AFR|ET|ET000|JIMMA
Ethiopia	Mekele, ET	AFR|ET|ET000|MEKELE
Falkland Islands	Stanley, FK	SAM|FK|FK---|STANLEY
Faroe Islands	Thorshavn, FO	EUR|FO|FO---|THORSHAVN
Fiji	Suva, FJ	OCN|FJ|FJ001|SUVA
Finland	Espoo, FI	EUR|FI|FI002|ESPOO
Finland	Helsinki, FI	EUR|FI|FI002|HELSINKI
Finland	Oulu, FI	EUR|FI|FI007|OULU
Finland	Tampere, FI	EUR|FI|FI005|TAMPERE
Finland	Turku, FI	EUR|FI|FI005|TURKU
Finland	Vantaa, FI	EUR|FI|FI002|VANTAA
France	Aix-En-Provence, FR	EUR|FR|FR021|AIX-EN-PROVENCE
France	Amiens, FR	EUR|FR|FR019|AMIENS
France	Angers, FR	EUR|FR|FR018|ANGERS
France	Annecy, FR	EUR|FR|FR022|ANNECY
France	Avignon, FR	EUR|FR|FR021|AVIGNON
France	Besancon, FR	EUR|FR|FR010|BESANÇON
France	Bordeaux, FR	EUR|FR|FR002|BORDEAUX
France	Boulogne-Billancourt, FR	EUR|FR|FR012|BOULOGNE-BILLANCOURT
France	Brest, FR	EUR|FR|FR006|BREST
France	Briançon, FR	EUR|FR|FR021|BRIANÇON
France	Caen, FR	EUR|FR|FR004|CAEN
France	Clermont-Ferrand, FR	EUR|FR|FR003|CLERMONT-FERRAND
France	Dijon, FR	EUR|FR|FR005|DIJON
France	Gap, FR	EUR|FR|FR021|GAP
France	Grenoble, FR	EUR|FR|FR022|GRENOBLE
France	Le Havre, FR	EUR|FR|FR011|LE HAVRE
France	Le Mans, FR	EUR|FR|FR018|LE MANS
France	Lille, FR	EUR|FR|FR017|LILLE

France	Limoges, FR	EUR|FR|FR012|LIMOGES
France	Lyon, FR	EUR|FR|FR022|LYON
France	Marseille, FR	EUR|FR|FR021|MARSEILLE
France	Metz, FR	EUR|FR|FR015|METZ
France	Montélimar, FR	EUR|FR|FR022|MONTÉLIMAR
France	Montpellier, FR	EUR|FR|FR013|MONTPELLIER
France	Mulhouse, FR	EUR|FR|FR001|MULHOUSE
France	Nantes, FR	EUR|FR|FR018|NANTES
France	Nice, FR	EUR|FR|FR021|NICE
France	Nimes, FR	EUR|FR|FR013|NÎMES
France	Orleans, FR	EUR|FR|FR007|ORLÉANS
France	Paris, FR	EUR|FR|FR012|PARIS
France	Pau, FR	EUR|FR|FR022|PAU
France	Perpignan, FR	EUR|FR|FR013|PERPIGNAN
France	Reims, FR	EUR|FR|FR008|REIMS
France	Rennes, FR	EUR|FR|FR006|RENNES
France	Rouen, FR	EUR|FR|FR011|ROUEN
France	Saint Etienne, FR	EUR|FR|FR022|SAINT-ÉTIENNE
France	Strasbourg, FR	EUR|FR|FR001|STRASBOURG
France	Toulon, FR	EUR|FR|FR021|TOULON
France	Toulouse, FR	EUR|FR|FR016|TOULOUSE
France	Tours, FR	EUR|FR|FR007|TOURS
France	Villeurbanne, FR	EUR|FR|FR012|VILLEURBANNE
French Guiana	Cayenne, GF	SAM|GF|FG001|CAYENNE
French Polynesia	Papeete, PF	OCN|PF|FP000|PAPEETE
Gabon	Libreville, GA	AFR|GA|GB001|LIBREVILLE
Gabon	Pointe-Noire, GA	AFR|GA|GB003|POINTE-NOIRE
Georgia	Batumi, GE	ASI|GE|GG000|BATUMI
Georgia	Kutaisi, GE	ASI|GE|GG000|KUTAISI
Georgia	Rustavi, GE	ASI|GE|GG000|RUSTAVI
Georgia	Sukhumi, GE	ASI|GE|GG000|SUKHUMI
Georgia	Tbilisi, GE	ASI|GE|GG000|TBILISI
Germany	Aachen, DE	EUR|DE|GM011|AACHEN
Germany	Augsburg, DE	EUR|DE|GM002|AUGSBURG
Germany	Bergisch Gladbach, DE	EUR|DE|GM011|BERGISCH GLADBACH
Germany	Berlin, DE	EUR|DE|GM003|BERLIN
Germany	Bielefeld, DE	EUR|DE|GM011|BIELEFELD
Germany	Bochum, DE	EUR|DE|GM011|BOCHUM
Germany	Bonn, DE	EUR|DE|GM011|BONN
Germany	Bottrop, DE	EUR|DE|GM011|BOTTROP
Germany	Braunschweig, DE	EUR|DE|GM009|BRAUNSCHWEIG
Germany	Bremen, DE	EUR|DE|GM005|BREMEN
Germany	Bremerhaven, DE	EUR|DE|GM005|BREMERHAVEN

Germany	Chemnitz, DE	EUR|DE|GM014|CHEMNITZ
Germany	Cottbus, DE	EUR|DE|GM004|COTTBUS
Germany	Darmstadt, DE	EUR|DE|GM007|DARMSTADT
Germany	Dortmund, DE	EUR|DE|GM011|DORTMUND
Germany	Dresden, DE	EUR|DE|GM014|DRESDEN
Germany	Duisburg, DE	EUR|DE|GM011|DUISBURG
Germany	Dusseldorf, DE	EUR|DE|GM011|DÜSSELDORF
Germany	Erfurt, DE	EUR|DE|GM017|ERFURT
Germany	Erlangen, DE	EUR|DE|GM002|ERLANGEN
Germany	Essen, DE	EUR|DE|GM011|ESSEN
Germany	Frankfurt Am Main, DE	EUR|DE|GM007|FRANKFURT AM MAIN
Germany	Freiburg Im Breisgau, DE	EUR|DE|GM001|FREIBURG IM BREISGAU
Germany	Furth, DE	EUR|DE|GM002|FÜRTH
Germany	Gelsenkirchen, DE	EUR|DE|GM011|GELSENKIRCHEN
Germany	Gera, DE	EUR|DE|GM017|GERA
Germany	Gladbach, DE	EUR|DE|GM011|MÖNCHENGLADBACH
Germany	Gottingen, DE	EUR|DE|GM007|GÖTTINGEN
Germany	Hagen, DE	EUR|DE|GM015|HAGEN
Germany	Halle, DE	EUR|DE|GM009|HALLE
Germany	Hamburg, DE	EUR|DE|GM006|HAMBURG
Germany	Hamm, DE	EUR|DE|GM009|HAMM
Germany	Hannover, DE	EUR|DE|GM009|HANNOVER
Germany	Heidelberg, DE	EUR|DE|GM001|HEIDELBERG
Germany	Heilbronn, DE	EUR|DE|GM001|HEILBRONN
Germany	Herne, DE	EUR|DE|GM011|HERNE
Germany	Hildesheim, DE	EUR|DE|GM009|HILDESHEIM
Germany	Ingolstadt, DE	EUR|DE|GM002|INGOLSTADT
Germany	Kaiserslautern, DE	EUR|DE|GM012|KAISERSLAUTERN
Germany	Karlsruhe, DE	EUR|DE|GM001|KARLSRUHE
Germany	Kassel, DE	EUR|DE|GM007|KASSEL
Germany	Kiel, DE	EUR|DE|GM016|KIEL
Germany	Koblenz, DE	EUR|DE|GM012|KOBLENZ
Germany	Koln, DE	EUR|DE|GM011|KÖLN
Germany	Krefeld, DE	EUR|DE|GM011|KREFELD
Germany	Leipzig, DE	EUR|DE|GM014|LEIPZIG
Germany	Leverkusen, DE	EUR|DE|GM011|LEVERKUSEN
Germany	Lubeck, DE	EUR|DE|GM016|LÜBECK
Germany	Ludwigshafen, DE	EUR|DE|GM012|LÜDWIGSHAFEN AM RHEIN
Germany	Magdeburg, DE	EUR|DE|GM015|MAGDEBURG
Germany	Mainz, DE	EUR|DE|GM002|MAINZ
Germany	Mannheim, DE	EUR|DE|GM001|MANNHEIM
Germany	Moers, DE	EUR|DE|GM011|MOERS

Germany	Mulheim, DE	EUR|DE|GM011|MÜLHEIM AN DER RUHR
Germany	Munich, DE	EUR|DE|GM002|MÜNCHEN
Germany	Munster, DE	EUR|DE|GM007|MÜNSTER
Germany	Neuss, DE	EUR|DE|GM011|NEUSS
Germany	Nurnberg, DE	EUR|DE|GM002|NÜRNBERG
Germany	Oberhausen, DE	EUR|DE|GM007|OBERHAUSEN
Germany	Offenbach Am Main, DE	EUR|DE|GM007|OFFENBACH AM MAIN
Germany	Oldenburg, DE	EUR|DE|GM009|OLDENBURG
Germany	Osnabruck, DE	EUR|DE|GM009|OSNABRÜCK
Germany	Paderborn, DE	EUR|DE|GM011|PADERBORN
Germany	Pforzheim, DE	EUR|DE|GM001|PFORZHEIM
Germany	Potsdam, DE	EUR|DE|GM004|POTSDAM
Germany	Recklinghausen, DE	EUR|DE|GM011|RECKLINGHAUSEN
Germany	Regensburg, DE	EUR|DE|GM002|REGENSBURG
Germany	Remscheid, DE	EUR|DE|GM011|REMSCHEID
Germany	Reutlingen, DE	EUR|DE|GM001|REUTLINGEN
Germany	Rostock, DE	EUR|DE|GM010|ROSTOCK
Germany	Saarbrucken, DE	EUR|DE|GM013|SAARBRÜCKEN
Germany	Salzgitter, DE	EUR|DE|GM009|SALZGITTER
Germany	Schwerin, DE	EUR|DE|GM010|SCHWERIN
Germany	Siegen, DE	EUR|DE|GM011|SIEGEN
Germany	Solingen, DE	EUR|DE|GM011|SOLINGEN
Germany	Stuttgart, DE	EUR|DE|GM001|STUTTGART
Germany	Ulm, DE	EUR|DE|GM001|ULM
Germany	Wiesbaden, DE	EUR|DE|GM007|WIESBADEN
Germany	Witten, DE	EUR|DE|GM011|WITTEN
Germany	Wolfsburg, DE	EUR|DE|GM009|WOLFSBURG
Germany	Wuppertal, DE	EUR|DE|GM011|WUPPERTAL
Germany	Wurzburg, DE	EUR|DE|GM002|WÜRZBURG
Germany	Zwickau, DE	EUR|DE|GM014|ZWICKAU
Ghana	Accra, GH	AFR|GH|GH000|ACCRA
Ghana	Bolgatanga, GH	AFR|GH|GH000|BOLGATANGA
Ghana	Cape Cost, GH	AFR|GH|GH000|CAPE COST
Ghana	Ho, GH	AFR|GH|GH000|HO
Ghana	Koforidua, GH	AFR|GH|GH000|KOFORIDUA
Ghana	Kumasi, GH	AFR|GH|GH010|KUMASI
Ghana	Obuasi, GH	AFR|GH|GH000|OBUASI
Ghana	Sekondi-Takoradi, GH	AFR|GH|GH000|SEKONDI-TAKORADI
Ghana	Sunyani, GH	AFR|GH|GH000|SUNYANI
Ghana	Tamale, GH	AFR|GH|GH000|TAMALE
Ghana	Tema, GH	AFR|GH|GH000|TEMA
Gibraltar	Gibraltar, GI	EUR|GI|GI---|GIBRALTAR
Greece	Athinai, GR	EUR|GR|GR007|ATHINAI

Greece	Iraclion, GR	EUR|GR|GR020|IRACLION
Greece	Larissa, GR	EUR|GR|GR034|LARISSA
Greece	Patrai, GR	EUR|GR|GR003|PATRAI
Greece	Piraievs, GR	EUR|GR|GR007|PIRAIÉVS
Greece	Salonika, GR	EUR|GR|GR048|SALONIKA
Greece	Volos, GR	EUR|GR|GR038|VOLOS
Greenland	Nuuk, GL	ARC|GL|GL003|NUUK
Grenada	Saint George'S, GD	CAC|GD|GJ003|SAINT GEORGE'S
Guadeloupe	Basse-Terre, KN	CAC|GP|GP---|BASSE-TERRE
Guam	Agana, GU	OCN|GU|GU000|AGANA
Guatemala	Guatemala, GT	CAC|GT|GT007|GUATEMALA
Guinea	Conakry, GN	AFR|GN|GV004|CONAKRY
Guinea-Bissau	Bissau, GW	AFR|GW|PU000|BISSAU
Guyana	Georgetown, GY	SAM|GY|GY003|GEORGETOWN
Haiti	Cap-Haitien, HT	CAC|HT|HA004|CAP-HAITIEN
Haiti	Carrefour, HT	CAC|HT|HA001|CARREFOUR
Haiti	Delmas, HT	CAC|HT|HA003|DELMAS
Haiti	Port-Au-Prince, HT	CAC|HT|HA007|PORT-AU-PRINCE
Honduras	San Pedro Sula, HN	CAC|HN|HO006|SAN PEDRO SULA
Honduras	Tegucigalpa, HN	CAC|HN|HO008|TEGUCIGALPA
Hong Kong	Hong Kong, HK	ASI|HK|HK---|HONG KONG
Hungary	Budapest, HU	EUR|HU|HU006|BUDAPEST
Hungary	Debrecen, HU	EUR|HU|HU008|DEBRECEN
Hungary	Gyor, HU	EUR|HU|HU012|GYÖR
Hungary	Kecskemet, HU	EUR|HU|HU001|KECSKEMÉT
Hungary	Miskolc, HU	EUR|HU|HU021|MISKOLC
Hungary	Nyiregyhaza, HU	EUR|HU|HU029|NYIREGYHAZA
Hungary	Pecs, HU	EUR|HU|HU025|PÉCS
Hungary	Stuhlweissenburg, HU	EUR|HU|HU011|SZÉKESFEHÉRVAR
Hungary	Szeged, HU	EUR|HU|HU030|SZEGED
Iceland	Reykjavik, IS	ARC|IS|IC010|REYKJAVIK
India	Abohar, IN	ASI|IN|IN028|ABOHAR
India	Adoni, IN	ASI|IN|IN002|ADONI
India	Agartala, IN	ASI|IN|IN032|AGARTALA
India	Agra, IN	ASI|IN|IN033|AGRA
India	Ahmedabad, IN	ASI|IN|IN012|AHMEDABAD
India	Ahmednagar, IN	ASI|IN|IN021|AHMEDNAGAR
India	Aizawl, IN	ASI|IN|IN024|AIZAWL
India	Ajmer, IN	ASI|IN|IN029|AJMER
India	Akola, IN	ASI|IN|IN021|AKOLA
India	Aligarh, IN	ASI|IN|IN033|ALIGARH
India	Alipur, IN	ASI|IN|IN036|ALIPUR
India	Allahabad, IN	ASI|IN|IN033|ALLAHABAD

India	Alwar, IN	ASI|IN|IN029|ALWAR
India	Ambala, IN	ASI|IN|IN013|AMBALA
India	Amravati, IN	ASI|IN|IN020|AMRAVATI
India	Amritsar, IN	ASI|IN|IN028|AMRITSAR
India	Amroha, IN	ASI|IN|IN033|AMROHA
India	Anand, IN	ASI|IN|IN012|ANAND
India	Arcot, IN	ASI|IN|IN031|ARCOT
India	Arrah, IN	ASI|IN|IN005|ARRAH
India	Asansol, IN	ASI|IN|IN005|ASANSOL
India	Aurangabad, IN	ASI|IN|IN021|AURANGABAD
India	Baharampur, IN	ASI|IN|IN036|BAHARAMPUR
India	Bahraich, IN	ASI|IN|IN033|BAHRAICH
India	Baleshwar, IN	ASI|IN|IN026|BALESHWAR
India	Bally, IN	ASI|IN|IN036|BALLY
India	Balurghat, IN	ASI|IN|IN036|BALURGHAT
India	Bangalore, IN	ASI|IN|IN017|BANGALORE
India	Bankura, IN	ASI|IN|IN036|BANKURA
India	Baranagar, IN	ASI|IN|IN035|BARANAGAR
India	Barddhaman, IN	ASI|IN|IN036|BARDDHAMAN
India	Bareilly, IN	ASI|IN|IN033|BAREILLY
India	Basirhat, IN	ASI|IN|IN036|BASIRHAT
India	Batala, IN	ASI|IN|IN015|BATALA
India	Beawar, IN	ASI|IN|IN029|BEAWAR
India	Belgaum, IN	ASI|IN|IN017|BELGAUM
India	Bellary, IN	ASI|IN|IN017|BELLARY
India	Bhadravati, IN	ASI|IN|IN017|BHADRAVATI
India	Bhagalpur, IN	ASI|IN|IN005|BHAGALPUR
India	Bharatpur, IN	ASI|IN|IN020|BHARATPUR
India	Bharuch, IN	ASI|IN|IN012|BHARUCH
India	Bhatpara, IN	ASI|IN|IN036|BHATPARA
India	Bhavnagar, IN	ASI|IN|IN012|BHAVNAGAR
India	Bhilai Nagar, IN	ASI|IN|IN020|BHILAI NAGAR
India	Bhilwara, IN	ASI|IN|IN029|BHILWARA
India	Bhind, IN	ASI|IN|IN020|BHIND
India	Bhiwandi, IN	ASI|IN|IN021|BHIWANDI
India	Bhiwani, IN	ASI|IN|IN013|BHIWANI
India	Bhopal, IN	ASI|IN|IN020|BHOPAL
India	Bhubaneswar, IN	ASI|IN|IN026|BHUBANESWAR
India	Bhuj, IN	ASI|IN|IN012|BHUJ
India	Bhusawal, IN	ASI|IN|IN021|BHUSAWAL
India	Bid, IN	ASI|IN|IN021|BID
India	Bidar, IN	ASI|IN|IN017|BIDAR
India	Bihar Sharif, IN	ASI|IN|IN005|BIHAR SHARIF

India	Bijapur, IN	ASI|IN|IN017|BIJAPUR
India	Bikaner, IN	ASI|IN|IN029|BIKANER
India	Bilaspur, IN	ASI|IN|IN020|BILASPUR
India	Bokaro Steel City, IN	ASI|IN|IN005|BOKARO STEEL CITY
India	Brahmapur, IN	ASI|IN|IN026|BRAHMAPUR
India	Budaun, IN	ASI|IN|IN033|BUDAUN
India	Bulandshahr, IN	ASI|IN|IN033|BULANDSHAHR
India	Burhanpur, IN	ASI|IN|IN020|BURHANPUR
India	Calcutta, IN	ASI|IN|IN036|CALCUTTA
India	Chandannagar, IN	ASI|IN|IN036|CHANDAN NAGAR
India	Chandigarh, IN	ASI|IN|IN006|CHANDIGARH
India	Chandrapur, IN	ASI|IN|IN021|CHANDRAPUR
India	Chapra, IN	ASI|IN|IN005|CHAPRA
India	Chitradurga, IN	ASI|IN|IN017|CHITRADURGA
India	Chittoor, IN	ASI|IN|IN002|CHITTOOR
India	Coimbatore, IN	ASI|IN|IN031|COIMBATORE
India	Cuddalore, IN	ASI|IN|IN031|CUDDALORE
India	Cuddapah, IN	ASI|IN|IN002|CUDDAPAH
India	Cuttack, IN	ASI|IN|IN026|CUTTACK
India	Damoh, IN	ASI|IN|IN020|DAMOH
India	Darbhanga, IN	ASI|IN|IN005|DARBHANGA
India	Davangere, IN	ASI|IN|IN017|DAVANGERE
India	Dehradun, IN	ASI|IN|IN033|DEHRADUN
India	Delhi, IN	ASI|IN|IN010|DELHI
India	Dewas, IN	ASI|IN|IN020|DEWAS
India	Dhanbad, IN	ASI|IN|IN005|DHANBAD
India	Dhule, IN	ASI|IN|IN021|DHULE
India	Dibrugarh, IN	ASI|IN|IN004|DIBRUGARH
India	Dindigul, IN	ASI|IN|IN031|DINDIGUL
India	Durg, IN	ASI|IN|IN020|DURG
India	Durgapur, IN	ASI|IN|IN036|DURGAPUR
India	Eluru, IN	ASI|IN|IN002|ELURU
India	English Bazar, IN	ASI|IN|IN036|ENGLISH BAZAR
India	Erode, IN	ASI|IN|IN031|ERODE
India	Etawah, IN	ASI|IN|IN029|ETAWAH
India	Faizabad, IN	ASI|IN|IN033|FAIZABAD
India	Faridabad, IN	ASI|IN|IN013|FARIDABAD
India	Farrukhabad-Cum-Fategarh, IN	ASI|IN|IN033|FARRUKHABAD-CUM-FATEGARH
India	Fatehpur, IN	ASI|IN|IN029|FATEHPUR
India	Firozabad, IN	ASI|IN|IN017|FIROZABAD
India	Gadag, IN	ASI|IN|IN017|GADAG-BETGERI
India	Gandhidham, IN	ASI|IN|IN012|GANDHIDHAM

India	Gandhinagar, IN	ASI|IN|IN012|GANDHINAGAR
India	Gaya, IN	ASI|IN|IN005|GAYA
India	Ghaziabad, IN	ASI|IN|IN033|GHAZIABAD
India	Godhra, IN	ASI|IN|IN012|GODHRA
India	Gorakhpur, IN	ASI|IN|IN033|GORAKHPUR
India	Gudivada, IN	ASI|IN|IN002|GUDIVADA
India	Gulbarga, IN	ASI|IN|IN017|GULBARGA
India	Guna, IN	ASI|IN|IN020|GUNA
India	Guntur, IN	ASI|IN|IN002|GUNTUR
India	Gurgaon, IN	ASI|IN|IN013|GURGAON
India	Guruvayur, IN	ASI|IN|IN018|GURUVAYUR
India	Gwalior, IN	ASI|IN|IN020|GWALIOR
India	Habra, IN	ASI|IN|IN036|HABRA
India	Haora, IN	ASI|IN|IN036|HAORA
India	Hapur, IN	ASI|IN|IN033|HAPUR
India	Hardwar, IN	ASI|IN|IN033|HARDWAR
India	Hassan, IN	ASI|IN|IN017|HASSAN
India	Hathras, IN	ASI|IN|IN033|HATHRAS
India	Hindupur, IN	ASI|IN|IN002|HINDUPUR
India	Hisar, IN	ASI|IN|IN013|HISAR
India	Hoshiarpur, IN	ASI|IN|IN028|HOSHIARPUR
India	Hospet, IN	ASI|IN|IN017|HOSPET
India	Hubli, IN	ASI|IN|IN017|HUBLI-DHARWAD
India	Hyderabad, IN	ASI|IN|IN002|HYDERABAD
India	Imphal, IN	ASI|IN|IN022|IMPHAL
India	Indore, IN	ASI|IN|IN020|INDORE
India	Jabalpur, IN	ASI|IN|IN020|JABALPUR
India	Jaipur, IN	ASI|IN|IN029|JAIPUR
India	Jalandhar, IN	ASI|IN|IN028|JALANDHAR
India	Jalgaon, IN	ASI|IN|IN021|JALGAON
India	Jalna, IN	ASI|IN|IN021|JALNA
India	Jamnagar, IN	ASI|IN|IN012|JAMNAGAR
India	Jamshedpur, IN	ASI|IN|IN005|JAMSHEDPUR
India	Jaunpur, IN	ASI|IN|IN033|JAUNPUR
India	Jhansi, IN	ASI|IN|IN033|JHANSI
India	Jodhpur, IN	ASI|IN|IN029|JODHPUR
India	Jorhat, IN	ASI|IN|IN004|JORHAT
India	Junagadh, IN	ASI|IN|IN012|JUNAGADH
India	Kakinada, IN	ASI|IN|IN002|KAKINADA
India	Kalyan, IN	ASI|IN|IN021|KALYAN
India	Kamarhati, IN	ASI|IN|IN036|KAMARHATI
India	Kamptee, IN	ASI|IN|IN021|KAMPTEE
India	Kanchipuram, IN	ASI|IN|IN031|KANCHIPURAM

India	Kanchrapara, IN	ASI|IN|IN036|KANCHRAPARA
India	Kanhangad, IN	ASI|IN|IN018|KANHANGAD
India	Kannur, IN	ASI|IN|IN018|KANNUR
India	Kanpur, IN	ASI|IN|IN033|KANPUR
India	Karaikkudi, IN	ASI|IN|IN031|KARAIKKUDI
India	Karimnagar, IN	ASI|IN|IN002|KARIMNAGAR
India	Karnal, IN	ASI|IN|IN013|KARNAL
India	Karur, IN	ASI|IN|IN031|KARUR
India	Katihar, IN	ASI|IN|IN005|KATIHAR
India	Khammam, IN	ASI|IN|IN002|KHAMMAM
India	Khandwa, IN	ASI|IN|IN020|KHANDWA
India	Kharagpur, IN	ASI|IN|IN005|KHARAGPUR
India	Kochi, IN	ASI|IN|IN018|KOCHI
India	Kolar, IN	ASI|IN|IN017|KOLAR
India	Kolar Gold Fields, IN	ASI|IN|IN017|KOLAR GOLD FIELDS
India	Kolhapur, IN	ASI|IN|IN021|KOLHAPUR
India	Kollam, IN	ASI|IN|IN018|KOLLAM
India	Korba, IN	ASI|IN|IN020|KORBA
India	Kota, IN	ASI|IN|IN029|KOTA
India	Kothagudem, IN	ASI|IN|IN002|KOTHAGUDEM
India	Kottayam, IN	ASI|IN|IN018|KOTTAYAM
India	Kozhikode, IN	ASI|IN|IN018|KOZHIKODE
India	Krishnanagar, IN	ASI|IN|IN036|KRISHNANAGAR
India	Kumbakonam, IN	ASI|IN|IN031|KUMBAKONAM
India	Kurnool, IN	ASI|IN|IN002|KURNOOL
India	Lucknow, IN	ASI|IN|IN033|LUCKNOW
India	Ludhiana, IN	ASI|IN|IN028|LUDHIANA
India	Machilipatnam, IN	ASI|IN|IN002|MACHILIPATNAM
India	Madras, IN	ASI|IN|IN031|MADRAS
India	Madurai, IN	ASI|IN|IN031|MADURAI
India	Mahbubnagar, IN	ASI|IN|IN002|MAHBUBNAGAR
India	Mahesana, IN	ASI|IN|IN012|MAHESANA
India	Malegaon, IN	ASI|IN|IN021|MALEGAON
India	Mandya, IN	ASI|IN|IN017|MANDYA
India	Mangalore, IN	ASI|IN|IN017|MANGALORE
India	Mathura, IN	ASI|IN|IN033|MATHURA
India	Maunath Bhanjan, IN	ASI|IN|IN033|MAUNATH BHANJAN
India	Medinipur, IN	ASI|IN|IN036|MEDINIPUR
India	Meerut, IN	ASI|IN|IN033|MEERUT
India	Mirzapur-Cum-Vindhyachal, IN	ASI|IN|IN033|MIRZAPUR-CUM-VINDHYACHAL
India	Moga, IN	ASI|IN|IN028|MOGA
India	Moradabad, IN	ASI|IN|IN033|MORADABAD

India	Morena, IN	ASI|IN|IN020|MORENA
India	Morvi, IN	ASI|IN|IN012|MORVI
India	Mumbai, IN	ASI|IN|IN021|MUMBAI
India	Munger, IN	ASI|IN|IN005|MUNGER
India	Murwara, IN	ASI|IN|IN020|MURWARA
India	Muzaffarnagar, IN	ASI|IN|IN033|MUZAFFARNAGAR
India	Muzaffarpur, IN	ASI|IN|IN005|MUZAFFARPUR
India	Mysore, IN	ASI|IN|IN017|MYSORE
India	Nabadwip, IN	ASI|IN|IN036|NABADWIP
India	Nadiad, IN	ASI|IN|IN012|NADIAD
India	Nagercoil, IN	ASI|IN|IN031|NAGERCOIL
India	Nagpur, IN	ASI|IN|IN021|NAGPUR
India	Naihati, IN	ASI|IN|IN036|NAIHATI
India	Nanded, IN	ASI|IN|IN021|NANDED
India	Nandyal, IN	ASI|IN|IN002|NANDYAL
India	Navsari, IN	ASI|IN|IN012|NAVSARI
India	Nellore, IN	ASI|IN|IN002|NELLORE
India	New Delhi, IN	ASI|IN|IN010|NEW DELHI
India	Neyveli, IN	ASI|IN|IN031|NEYVELI
India	Nizamabad, IN	ASI|IN|IN002|NIZAMABAD
India	Ondal, IN	ASI|IN|IN036|ONDAL
India	Ongole, IN	ASI|IN|IN002|ONGOLE
India	Pali, IN	ASI|IN|IN020|PALI
India	Panihati, IN	ASI|IN|IN036|PANIHATI
India	Panipat, IN	ASI|IN|IN013|PANIPAT
India	Parbhani, IN	ASI|IN|IN021|PARBHANI
India	Patan, IN	ASI|IN|IN012|PATAN
India	Pathankot, IN	ASI|IN|IN028|PATHANKOT
India	Patiala, IN	ASI|IN|IN028|PATIALA
India	Patratu, IN	ASI|IN|IN005|PATRATU
India	Pilibhit, IN	ASI|IN|IN033|PILIBHIT
India	Pollachi, IN	ASI|IN|IN031|POLLACHI
India	Pondicherry, IN	ASI|IN|IN027|PONDICHERRY
India	Porbandar, IN	ASI|IN|IN012|PORBANDAR
India	Proddatur, IN	ASI|IN|IN002|PRODDATUR
India	Pune, IN	ASI|IN|IN021|PUNE
India	Puri, IN	ASI|IN|IN026|PURI
India	Purnia, IN	ASI|IN|IN005|PURNIA
India	Rae Bareli, IN	ASI|IN|IN033|RAE BARELI
India	Raichur, IN	ASI|IN|IN017|RAICHUR
India	Raiganj, IN	ASI|IN|IN036|RAIGANJ
India	Raipur, IN	ASI|IN|IN033|RAIPUR
India	Rajahmundry, IN	ASI|IN|IN002|RAJAHMUNDRY

India	Rajapalaiyam, IN	ASI|IN|IN031|RAJAPALAIYAM
India	Rajkot, IN	ASI|IN|IN012|RAJKOT
India	Rajnandgain, IN	ASI|IN|IN020|RAJNANDGAIN
India	Rampur, IN	ASI|IN|IN036|RAMPUR
India	Ranaghat, IN	ASI|IN|IN036|RANAGHAT
India	Ranchi, IN	ASI|IN|IN005|RANCHI
India	Ratlam, IN	ASI|IN|IN020|RATLAM
India	Raurkela, IN	ASI|IN|IN026|RAURKELA
India	Rewa, IN	ASI|IN|IN020|REWA
India	Rohtak, IN	ASI|IN|IN013|ROHTAK
India	Saharanpur, IN	ASI|IN|IN033|SAHARANPUR
India	Salem, IN	ASI|IN|IN031|SALEM
India	Sambalpur, IN	ASI|IN|IN026|SAMBALPUR
India	Sambhal, IN	ASI|IN|IN033|SAMBHAL
India	Sangli, IN	ASI|IN|IN021|SANGLI
India	Santipur, IN	ASI|IN|IN036|SANTIPUR
India	Satna, IN	ASI|IN|IN020|SATNA
India	Serampore, IN	ASI|IN|IN036|SERAMPORE
India	Shahjahanpur, IN	ASI|IN|IN033|SHAHJAHANPUR
India	Shillong, IN	ASI|IN|IN023|SHILLONG
India	Shimoga, IN	ASI|IN|IN017|SHIMOGA
India	Sikar, IN	ASI|IN|IN029|SIKAR
India	Silchar, IN	ASI|IN|IN004|SILCHAR
India	Siliguri, IN	ASI|IN|IN036|SILIGURI
India	Sirsa, IN	ASI|IN|IN013|SIRSA
India	Sitapur, IN	ASI|IN|IN033|SITAPUR
India	Sivakasi, IN	ASI|IN|IN031|SIVAKASI
India	Solapur, IN	ASI|IN|IN021|SOLAPUR
India	Sonipat, IN	ASI|IN|IN013|SONIPAT
India	South Dum Dum, IN	ASI|IN|IN036|SOUTH DUM DUM
India	Surat, IN	ASI|IN|IN012|SURAT
India	Tenali, IN	ASI|IN|IN002|TENALI
India	Thane, IN	ASI|IN|IN021|THANE
India	Thanjavur, IN	ASI|IN|IN031|THANJAVUR
India	Thiruvananthapuram, IN	ASI|IN|IN018|THIRUVANANTHAPURAM
India	Thrissur, IN	ASI|IN|IN018|THRISSUR
India	Tiruchchirappalli, IN	ASI|IN|IN031|TIRUCHCHIRAPPALLI
India	Tirunelveli, IN	ASI|IN|IN031|TIRUNELVELI
India	Tirupati, IN	ASI|IN|IN002|TIRUPATI
India	Tiruppur, IN	ASI|IN|IN031|TIRUPPUR
India	Tiruvannamalai, IN	ASI|IN|IN031|TIRUVANNAMALAI
India	Titagarh, IN	ASI|IN|IN036|TITAGARH
India	Tonk, IN	ASI|IN|IN029|TONK

India	Tumkur, IN	ASI|IN|IN017|TUMKUR
India	Tuticorin, IN	ASI|IN|IN031|TUTICORIN
India	Udaipur, IN	ASI|IN|IN029|UDAIPUR
India	Udupi, IN	ASI|IN|IN017|UDUPI
India	Ujjain, IN	ASI|IN|IN020|UJJAIN
India	Ulhasnagar, IN	ASI|IN|IN021|ULHASNAGAR
India	Unnao, IN	ASI|IN|IN033|UNNAO
India	Vadodara, IN	ASI|IN|IN012|VADODARA
India	Valparai, IN	ASI|IN|IN031|VALPARAI
India	Valsad, IN	ASI|IN|IN012|VALSAD
India	Varanasi, IN	ASI|IN|IN033|VARANASI
India	Vellore, IN	ASI|IN|IN031|VELLORE
India	Vijayawada, IN	ASI|IN|IN002|VIJAYAWADA
India	Visakhapatnam, IN	ASI|IN|IN002|VISAKHAPATNAM
India	Wadhwan, IN	ASI|IN|IN012|WADHWAN
India	Warangal, IN	ASI|IN|IN002|WARANGAL
India	Wardha, IN	ASI|IN|IN021|WARDHA
India	Yamunanagar, IN	ASI|IN|IN013|YAMUNANAGAR
India	Yavatmal, IN	ASI|IN|IN021|YAVATMAL
Indonesia	Ambon, ID	ASI|ID|ID015|AMBON
Indonesia	Balikpapan, ID	ASI|ID|ID013|BALIKPAPAN
Indonesia	Bandjarmasin, ID	ASI|ID|ID011|BANDJARMASIN
Indonesia	Bandung, ID	ASI|ID|ID004|BANDUNG
Indonesia	Bogor, ID	ASI|ID|ID026|BOGOR
Indonesia	Cirebon, ID	ASI|ID|ID026|CIREBON
Indonesia	Jakarta, ID	ASI|ID|ID009|JAKARTA
Indonesia	Jambi, ID	ASI|ID|ID010|JAMBI
Indonesia	Kediri, ID	ASI|ID|ID002|KEDIRI
Indonesia	Kotabaru, ID	ASI|ID|ID011|KOTABARU
Indonesia	Madiun, ID	ASI|ID|ID007|MADIUN
Indonesia	Magelang, ID	ASI|ID|ID004|MAGELANG
Indonesia	Malang, ID	ASI|ID|ID026|MALANG
Indonesia	Manado, ID	ASI|ID|ID022|MANADO
Indonesia	Medan, ID	ASI|ID|ID027|MEDAN
Indonesia	Padang, ID	ASI|ID|ID006|PADANG
Indonesia	Pakan Baru, ID	ASI|ID|ID018|PAKAN BARU
Indonesia	Palembang, ID	ASI|ID|ID024|PALEMBANG
Indonesia	Pematang Siantar, ID	ASI|ID|ID027|PEMATANG SIANTAR
Indonesia	Pontianak, ID	ASI|ID|ID006|PONTIANAK
Indonesia	Probolinggo, ID	ASI|ID|ID007|PROBOLINGGO
Indonesia	Samarinda, ID	ASI|ID|ID013|SAMARINDA
Indonesia	Semarang, ID	ASI|ID|ID004|SEMARANG
Indonesia	Sukabumi, ID	ASI|ID|ID026|SUKABUMI

Indonesia	Surabaya, ID	ASI|ID|ID026|SURABAYA
Indonesia	Surakarta, ID	ASI|ID|ID004|SURAKARTA
Indonesia	Tegal, ID	ASI|ID|ID004|TEGAL
Indonesia	Ujungpandang, ID	ASI|ID|ID019|UJUNGPANDANG
Indonesia	Yogyakarta, ID	ASI|ID|ID005|YOGYAKARTA
Iran	Abadan, IR	MEA|IR|IR016|ABADAN
Iran	Ahwaz, IR	MEA|IR|IR016|AHWAZ
Iran	Amol, IR	MEA|IR|IR021|AMOL
Iran	Andimeshk, IR	MEA|IR|IR016|ANDIMESHK
Iran	Arak, IR	MEA|IR|IR020|ARAK
Iran	Ardabil, IR	MEA|IR|IR001|ARDABIL
Iran	Babol, IR	MEA|IR|IR021|BABOL
Iran	Bandar-E-Abbas, IR	MEA|IR|IR011|BANDAR-E-ABBAS
Iran	Birjand, IR	MEA|IR|IR015|BIRJAND
Iran	Bojnurd, IR	MEA|IR|IR015|BOJNURD
Iran	Borujerd, IR	MEA|IR|IR019|BORUJERD
Iran	Bukand, IR	MEA|IR|IR000|BUKAND
Iran	Bushehr, IR	MEA|IR|IR004|BUSHEHR
Iran	Dezful, IR	MEA|IR|IR016|DEZFUL
Iran	Esfahan, IR	MEA|IR|IR006|ESFAHAN
Iran	Gadamabad, IR	MEA|IR|IR009|GONBAD-E-KAVUS
Iran	Gorgan, IR	MEA|IR|IR002|GORGAN
Iran	Hamadan, IR	MEA|IR|IR010|HAMADAN
Iran	Ilam, IR	MEA|IR|IR012|ILAM
Iran	Karaj, IR	MEA|IR|IR026|KARAJ
Iran	Kashan, IR	MEA|IR|IR006|KASHAN
Iran	Kerman, IR	MEA|IR|IR013|KERMAN
Iran	Kermanshah, IR	MEA|IR|IR014|KERMANSHAH
Iran	Kord-Shahr, IR	MEA|IR|IR005|KORD-SHAHR
Iran	Mahabad, IR	MEA|IR|IR002|MAHABAD
Iran	Malayer, IR	MEA|IR|IR010|MALAYER
Iran	Mashhad, IR	MEA|IR|IR015|MASHHAD
Iran	Masjed Soleyman, IR	MEA|IR|IR016|MASJED SOLEYMAN
Iran	Najafabad, IR	MEA|IR|IR006|NAJAFABAD
Iran	Neyshabur, IR	MEA|IR|IR015|NEYSHABUR
Iran	Orumiyeh, IR	MEA|IR|IR029|ORUMIYEH
Iran	Qaem Shahr, IR	MEA|IR|IR021|QAEM SHAHR
Iran	Qarchak, IR	MEA|IR|IR026|QARCHAK
Iran	Qazvin, IR	MEA|IR|IR028|QAZVIN
Iran	Qods, IR	MEA|IR|IR024|QODS
Iran	Qom, IR	MEA|IR|IR020|QOM
Iran	Rasht, IR	MEA|IR|IR008|RASHT
Iran	Sanandaj, IR	MEA|IR|IR018|SANANDAJ

Iran	Sari, IR	MEA|IR|IR021|SARI
Iran	Shahrud, IR	MEA|IR|IR024|SHAHRUD
Iran	Shiraz, IR	MEA|IR|IR007|SHIRAZ
Iran	Sirjan, IR	MEA|IR|IR013|SIRJAN
Iran	Tabriz, IR	MEA|IR|IR002|TABRIZ
Iran	Tehran, IR	MEA|IR|IR026|TEHRAN
Iran	Varamin, IR	MEA|IR|IR026|VARAMIN
Iran	Yazd, IR	MEA|IR|IR027|YAZD
Iran	Zabol, IR	MEA|IR|IR025|ZABOL
Iran	Zahedan, IR	MEA|IR|IR025|ZAHEDAN
Iran	Zanjan, IR	MEA|IR|IR028|ZANJAN
Iraq	Amara, IQ	MEA|IQ|IZ015|AMARA
Iraq	Baghdad, IQ	MEA|IQ|IZ010|BAGHDAD
Iraq	Basra, IQ	MEA|IQ|IZ002|BASRA
Iraq	Diwaniya, IQ	MEA|IQ|IZ004|DIWANIYA
Iraq	Erbil, IQ	MEA|IQ|IZ006|ERBIL
Iraq	Hilla, IQ	MEA|IQ|IZ009|HILLA
Iraq	Kadhimain, IQ	MEA|IQ|IZ010|KADHIMAIN
Iraq	Karradah Sharqiyah, IQ	MEA|IQ|IZ010|KARRADAH SHARQIYAH
Iraq	Kerbala, IQ	MEA|IQ|IZ014|KERBALA
Iraq	Kirkuk, IQ	MEA|IQ|IZ008|KIRKUK
Iraq	Kut, IQ	MEA|IQ|IZ018|KUT
Iraq	Majnoon, IQ	MEA|IQ|IZ010|MAJNOON
Iraq	Mosul, IQ	MEA|IQ|IZ016|MOSUL
Iraq	Najaf, IQ	MEA|IQ|IZ005|NAJAF
Iraq	Ramadi, IQ	MEA|IQ|IZ001|RAMADI
Ireland	Cork, IE	EUR|IE|EI004|CORK
Ireland	Derry, IE	EUR|IE|EI000|DERRY
Ireland	Dublin, IE	EUR|IE|EI006|DUBLIN
Isle Of Man	Douglas, IM	EUR|IM|IM---|DOUGLAS
Israel	Ashdod, IL	MEA|IL|IS002|ASHDOD
Israel	Ashkelon, IL	MEA|IL|IS001|ASHKELON
Israel	Bat Yam, IL	MEA|IL|IS005|BAT YAM
Israel	Beer Sheva, IL	MEA|IL|IS001|BE'ER SHEBA
Israel	Bene Beraq, IL	MEA|IL|IS005|BENE BERAQ
Israel	Dimona, IL	MEA|IL|IS001|DIMONA
Israel	Eilat , IL	MEA|IL|IS001|EILAT
Israel	Hadera, IL	MEA|IL|IS004|HADERA
Israel	Haifa, IL	MEA|IL|IS004|HAIFA
Israel	Holon, IL	MEA|IL|IS005|HOLON
Israel	Jerusalem, IL	MEA|IL|IS006|JERUSALEM
Israel	Keriat Shmona, IL	MEA|IL|IS003|KERIAT SHMONA
Israel	Metula, IL	MEA|IL|IS003|METULA

Israel	Netanya, IL	MEA|IL|IS002|NETANYA
Israel	Petah Tiqwa, IL	MEA|IL|IS002|PETAH TIQWA
Israel	Ramat Gan, IL	MEA|IL|IS005|RAMAT GAN
Israel	Rishon Leziyyon, IL	MEA|IL|IS002|RISHON LEZIYYON
Israel	Tel Aviv-Yafo, IL	MEA|IL|IS005|TEL AVIV-YAFO
Italy	Bari, IT	EUR|IT|IT013|BARI
Italy	Bergamo, IT	EUR|IT|IT009|BERGAMO
Italy	Bologna, IT	EUR|IT|IT005|BOLOGNA
Italy	Brescia, IT	EUR|IT|IT009|BRESCIA
Italy	Cagliari, IT	EUR|IT|IT014|CAGLIARI
Italy	Catania, IT	EUR|IT|IT015|CATANIA
Italy	Ferrara, IT	EUR|IT|IT005|FERRARA
Italy	Firenze, IT	EUR|IT|IT016|FIRENZE
Italy	Foggia, IT	EUR|IT|IT013|FOGGIA
Italy	Forli, IT	EUR|IT|IT005|FORLI
Italy	Genova, IT	EUR|IT|IT008|GENOVA
Italy	Latina, IT	EUR|IT|IT007|LATINA
Italy	Livorno, IT	EUR|IT|IT016|LIVORNO
Italy	Messina, IT	EUR|IT|IT015|MESSINA
Italy	Milano, IT	EUR|IT|IT009|MILANO
Italy	Modena, IT	EUR|IT|IT005|MODENA
Italy	Monza, IT	EUR|IT|IT009|MONZA
Italy	Napoli, IT	EUR|IT|IT004|NAPOLI
Italy	Novara, IT	EUR|IT|IT012|NOVARA
Italy	Padova, IT	EUR|IT|IT020|PADOVA
Italy	Palermo, IT	EUR|IT|IT015|PALERMO
Italy	Parma, IT	EUR|IT|IT005|PARMA
Italy	Perugia, IT	EUR|IT|IT018|PERUGIA
Italy	Pescara, IT	EUR|IT|IT001|PESCARA
Italy	Prato, IT	EUR|IT|IT016|PRATO
Italy	Ravenna, IT	EUR|IT|IT005|RAVENNA
Italy	Reggio Di Calabria, IT	EUR|IT|IT003|REGGIO DI CALABRIA
Italy	Rimini, IT	EUR|IT|IT005|RIMINI
Italy	Roma, IT	EUR|IT|IT007|ROMA
Italy	Salerno, IT	EUR|IT|IT003|SALERNO
Italy	Sassari, IT	EUR|IT|IT014|SASSARI
Italy	Siracusa, IT	EUR|IT|IT015|SIRACUSA
Italy	Taranto, IT	EUR|IT|IT013|TARANTO
Italy	Terni, IT	EUR|IT|IT018|TERNI
Italy	Torino, IT	EUR|IT|IT012|TORINO
Italy	Trento, IT	EUR|IT|IT017|TRENTO
Italy	Trieste, IT	EUR|IT|IT006|TRIESTE
Italy	Venezia, IT	EUR|IT|IT020|VENEZIA

Italy	Verona, IT	EUR|IT|IT020|VERONA
Italy	Vicenza, IT	EUR|IT|IT020|VICENZA
Ivory Coast	Abidjan, CI	AFR|CI|IV002|ABIDJAN
Ivory Coast	Bouaké, CI	AFR|CI|IV000|BOUAKÉ
Ivory Coast	Yamoussoukro, CI	AFR|CI|IV057|YAMOUSSOUKRO
Jamaica	Kingston, JM	CAC|JM|JM000|KINGSTON
Japan	Abiko, JP	ASI|JP|JA004|ABIKO
Japan	Ageo, JP	ASI|JP|JA035|AGEO
Japan	Akishima, JP	ASI|JP|JA041|AKISHIMA
Japan	Amagasaki, JP	ASI|JP|JA013|AMAGASAKI
Japan	Anjo, JP	ASI|JP|JA001|ANJO
Japan	Aomori, JP	ASI|JP|JA003|AOMORI
Japan	Asahikawa, JP	ASI|JP|JA012|ASAHIKAWA
Japan	Asaka, JP	ASI|JP|JA035|ASAKA
Japan	Ashikaga, JP	ASI|JP|JA039|ASHIKAGA
Japan	Atsugi, JP	ASI|JP|JA019|ATSUGI
Japan	Beppu, JP	ASI|JP|JA030|BEPPU
Japan	Chiba, JP	ASI|JP|JA004|CHIBA
Japan	Chigasaki, JP	ASI|JP|JA019|CHIGASAKI
Japan	Chofu, JP	ASI|JP|JA041|CHOFU
Japan	Daito, JP	ASI|JP|JA033|DAITO
Japan	Ebetsu, JP	ASI|JP|JA012|EBETSU
Japan	Ebina, JP	ASI|JP|JA019|EBINA
Japan	Fuji, JP	ASI|JP|JA038|FUJI
Japan	Fujieda, JP	ASI|JP|JA038|FUJIEDA
Japan	Fujimi, JP	ASI|JP|JA012|FUJIMI
Japan	Fujinomiya, JP	ASI|JP|JA038|FUJINOMIYA
Japan	Fukaya, JP	ASI|JP|JA035|FUKAYA
Japan	Fukui, JP	ASI|JP|JA006|FUKUI
Japan	Fukuoka, JP	ASI|JP|JA009|FUKUOKA
Japan	Fukuyama, JP	ASI|JP|JA011|FUKUYAMA
Japan	Funabashi, JP	ASI|JP|JA004|FUNABASHI
Japan	Gifu, JP	ASI|JP|JA009|GIFU
Japan	Habikino, JP	ASI|JP|JA033|HABIKINO
Japan	Hachinohe, JP	ASI|JP|JA003|HACHINOHE
Japan	Hachioji, JP	ASI|JP|JA041|HACHIOJI
Japan	Hakodate, JP	ASI|JP|JA012|HAKODATE
Japan	Hamamatsu, JP	ASI|JP|JA038|HAMAMATSU
Japan	Handa, JP	ASI|JP|JA001|HANDA
Japan	Higashihiroshima, JP	ASI|JP|JA011|HIGASHIHIROSHIMA
Japan	Higashikurume, JP	ASI|JP|JA041|HIGASHIKURUME
Japan	Higashimurayama, JP	ASI|JP|JA041|HIGASHIMURAYAMA
Japan	Higashiosaka, JP	ASI|JP|JA033|HIGASHIOSAKA

Japan	Hikone, JP	ASI|JP|JA036|HIKONE
Japan	Himeji, JP	ASI|JP|JA013|HIMEJI
Japan	Hino, JP	ASI|JP|JA041|HINO
Japan	Hirakata, JP	ASI|JP|JA033|HIRAKATA
Japan	Hiratsuka, JP	ASI|JP|JA019|HIRATSUKA
Japan	Hirosaki, JP	ASI|JP|JA003|HIROSAKI
Japan	Hiroshima, JP	ASI|JP|JA011|HIROSHIMA
Japan	Hitachi, JP	ASI|JP|JA014|HITACHI
Japan	Hofu, JP	ASI|JP|JA046|HOFU
Japan	Hoya, JP	ASI|JP|JA041|HOYA
Japan	Ibaraki, JP	ASI|JP|JA033|IBARAKI
Japan	Ichihara, JP	ASI|JP|JA004|ICHIHARA
Japan	Ichikawa, JP	ASI|JP|JA004|ICHIKAWA
Japan	Ichinomiya, JP	ASI|JP|JA001|ICHINOMIYA
Japan	Ikeda, JP	ASI|JP|JA029|IKEDA
Japan	Ikoma, JP	ASI|JP|JA028|IKOMA
Japan	Imabari, JP	ASI|JP|JA005|IMABARI
Japan	Inazawa, JP	ASI|JP|JA001|INAZAWA
Japan	Ise, JP	ASI|JP|JA023|ISE
Japan	Isesaki, JP	ASI|JP|JA010|ISESAKI
Japan	Ishinomaki, JP	ASI|JP|JA024|ISHINOMAKI
Japan	Itami, JP	ASI|JP|JA013|ITAMI
Japan	Iwakuni, JP	ASI|JP|JA046|IWAKUNI
Japan	Iwatsuki, JP	ASI|JP|JA035|IWATSUKI
Japan	Izumi, JP	ASI|JP|JA033|IZUMI
Japan	Joetsu, JP	ASI|JP|JA029|JOETSU
Japan	Kadoma, JP	ASI|JP|JA033|KADOMA
Japan	Kagoshima, JP	ASI|JP|JA018|KAGOSHIMA
Japan	Kakamigahara, JP	ASI|JP|JA009|KAKAMIGAHARA
Japan	Kakogawa, JP	ASI|JP|JA013|KAKOGAWA
Japan	Kamagaya, JP	ASI|JP|JA004|KAMAGAYA
Japan	Kanazawa, JP	ASI|JP|JA015|KANAZAWA
Japan	Kariya, JP	ASI|JP|JA001|KARIYA
Japan	Kashihara, JP	ASI|JP|JA028|KASHIHARA
Japan	Kashiwa, JP	ASI|JP|JA004|KASHIWA
Japan	Kasukabe, JP	ASI|JP|JA035|KASUKABE
Japan	Kawachinagano, JP	ASI|JP|JA033|KAWACHINAGANO
Japan	Kawagoe, JP	ASI|JP|JA035|KAWAGOE
Japan	Kawaguchi, JP	ASI|JP|JA035|KAWAGUCHI
Japan	Kawasaki, JP	ASI|JP|JA019|KAWASAKI
Japan	Kiryu, JP	ASI|JP|JA010|KIRYU
Japan	Kisarazu, JP	ASI|JP|JA004|KISARAZU
Japan	Kishiwada, JP	ASI|JP|JA033|KISHIWADA

Japan	Kitakyushu, JP	ASI|JP|JA007|KITAKYUSHU
Japan	Kitami, JP	ASI|JP|JA012|KITAMI
Japan	Kobe, JP	ASI|JP|JA013|KOBE
Japan	Kochi, JP	ASI|JP|JA038|KOCHI
Japan	Kodaira, JP	ASI|JP|JA041|KODAIRA
Japan	Kofu, JP	ASI|JP|JA047|KOFU
Japan	Koganei, JP	ASI|JP|JA041|KOGANEI
Japan	Kokubunji, JP	ASI|JP|JA041|KOKUBUNJI
Japan	Komaki, JP	ASI|JP|JA001|KOMAKI
Japan	Komatsu, JP	ASI|JP|JA015|KOMATSU
Japan	Koriyama, JP	ASI|JP|JA008|KORIYAMA
Japan	Koshigaya, JP	ASI|JP|JA035|KOSHIGAYA
Japan	Kumagaya, JP	ASI|JP|JA035|KUMAGAYA
Japan	Kumamoto, JP	ASI|JP|JA021|KUMAMOTO
Japan	Kurashiki, JP	ASI|JP|JA031|KURASHIKI
Japan	Kure, JP	ASI|JP|JA011|KURE
Japan	Kurume, JP	ASI|JP|JA007|KURUME
Japan	Kusatsu, JP	ASI|JP|JA010|KUSATSU
Japan	Kushiro, JP	ASI|JP|JA012|KUSHIRO
Japan	Kuwana, JP	ASI|JP|JA023|KUWANA
Japan	Kyoto, JP	ASI|JP|JA022|KYOTO
Japan	Machida, JP	ASI|JP|JA041|MACHIDA
Japan	Maebashi, JP	ASI|JP|JA010|MAEBASHI
Japan	Matsubara, JP	ASI|JP|JA033|MATSUBARA
Japan	Matsudo, JP	ASI|JP|JA004|MATSUDO
Japan	Mishima, JP	ASI|JP|JA038|MISHIMA
Japan	Mito, JP	ASI|JP|JA014|MITO
Japan	Miyakonojo, JP	ASI|JP|JA025|MIYAKONOJO
Japan	Miyazaki, JP	ASI|JP|JA025|MIYAZAKI
Japan	Moriguchi, JP	ASI|JP|JA033|MORIGUCHI
Japan	Morioka, JP	ASI|JP|JA016|MORIOKA
Japan	Muroran, JP	ASI|JP|JA012|MURORAN
Japan	Musashino, JP	ASI|JP|JA041|MUSASHINO
Japan	Nagano, JP	ASI|JP|JA026|NAGANO
Japan	Nagaoka, JP	ASI|JP|JA029|NAGAOKA
Japan	Nagareyama, JP	ASI|JP|JA035|NAGAREYAMA
Japan	Nagasaki, JP	ASI|JP|JA027|NAGASAKI
Japan	Nagoya, JP	ASI|JP|JA001|NAGOYA
Japan	Nara, JP	ASI|JP|JA028|NARA
Japan	Narashino, JP	ASI|JP|JA004|NARASHINO
Japan	Neyagawa, JP	ASI|JP|JA033|NEYAGAWA
Japan	Niigata, JP	ASI|JP|JA029|NIIGATA
Japan	Niihama, JP	ASI|JP|JA005|NIIHAMA

Japan	Niiza, JP	ASI|JP|JA035|NIIZA
Japan	Nishinomiya, JP	ASI|JP|JA013|NISHINOMIYA
Japan	Nishio, JP	ASI|JP|JA001|NISHIO
Japan	Nobeoka, JP	ASI|JP|JA025|NOBEOKA
Japan	Noda, JP	ASI|JP|JA004|NODA
Japan	Numazu, JP	ASI|JP|JA038|NUMAZU
Japan	Obihiro, JP	ASI|JP|JA012|OBIHIRO
Japan	Odawara, JP	ASI|JP|JA019|ODAWARA
Japan	Ogaki, JP	ASI|JP|JA009|OGAKI
Japan	Oita, JP	ASI|JP|JA030|OITA
Japan	Okayama, JP	ASI|JP|JA031|OKAYAMA
Japan	Okazaki, JP	ASI|JP|JA001|OKAZAKI
Japan	Okinawa, JP	ASI|JP|JA032|OKINAWA
Japan	Ome, JP	ASI|JP|JA041|OME
Japan	Omiya, JP	ASI|JP|JA014|OMIYA
Japan	Omuta, JP	ASI|JP|JA007|OMUTA
Japan	Osaka, JP	ASI|JP|JA009|OSAKA
Japan	Ota, JP	ASI|JP|JA006|OTA
Japan	Otaru, JP	ASI|JP|JA012|OTARU
Japan	Otsu, JP	ASI|JP|JA036|OTSU
Japan	Oyama, JP	ASI|JP|JA038|OYAMA
Japan	Saga, JP	ASI|JP|JA020|SAGA
Japan	Sagamihara, JP	ASI|JP|JA019|SAGAMIHARA
Japan	Sakai, JP	ASI|JP|JA014|SAKAI
Japan	Sanda, JP	ASI|JP|JA013|SANDA
Japan	Sapporo, JP	ASI|JP|JA012|SAPPORO
Japan	Sasebo, JP	ASI|JP|JA027|SASEBO
Japan	Sayama, JP	ASI|JP|JA035|SAYAMA
Japan	Sendai, JP	ASI|JP|JA018|SENDAI
Japan	Seto, JP	ASI|JP|JA001|SETO
Japan	Shimizu, JP	ASI|JP|JA029|SHIMIZU
Japan	Shimonoseki, JP	ASI|JP|JA046|SHIMONOSEKI
Japan	Shizuoka, JP	ASI|JP|JA038|SHIZUOKA
Japan	Soka, JP	ASI|JP|JA035|SOKA
Japan	Suita, JP	ASI|JP|JA033|SUITA
Japan	Suzuka, JP	ASI|JP|JA023|SUZUKA
Japan	Tachikawa, JP	ASI|JP|JA041|TACHIKAWA
Japan	Tajimi, JP	ASI|JP|JA009|TAJIMI
Japan	Takamatsu, JP	ASI|JP|JA017|TAKAMATSU
Japan	Takaoka, JP	ASI|JP|JA043|TAKAOKA
Japan	Takarazuka, JP	ASI|JP|JA013|TAKARAZUKA
Japan	Takasaki, JP	ASI|JP|JA010|TAKASAKI
Japan	Takatsuki, JP	ASI|JP|JA033|TAKATSUKI

Japan	Tama, JP	ASI|JP|JA031|TAMA
Japan	Toda, JP	ASI|JP|JA035|TODA
Japan	Tokorozawa, JP	ASI|JP|JA035|TOKOROZAWA
Japan	Tokushima, JP	ASI|JP|JA040|TOKUSHIMA
Japan	Tokuyama, JP	ASI|JP|JA046|TOKUYAMA
Japan	Tokyo, JP	ASI|JP|JA041|TOKYO
Japan	Tomakomai, JP	ASI|JP|JA012|TOMAKOMAI
Japan	Tondabayashi, JP	ASI|JP|JA033|TONDABAYASHI
Japan	Tottori, JP	ASI|JP|JA042|TOTTORI
Japan	Toyama, JP	ASI|JP|JA043|TOYAMA
Japan	Toyohashi, JP	ASI|JP|JA001|TOYOHASHI
Japan	Toyokawa, JP	ASI|JP|JA001|TOYOKAWA
Japan	Toyonaka, JP	ASI|JP|JA033|TOYONAKA
Japan	Toyota, JP	ASI|JP|JA001|TOYOTA
Japan	Tsu, JP	ASI|JP|JA023|TSU
Japan	Tsuchiura, JP	ASI|JP|JA014|TSUCHIURA
Japan	Tsukuba, JP	ASI|JP|JA014|TSUKUBA
Japan	Tsuruoka, JP	ASI|JP|JA045|TSURUOKA
Japan	Ube, JP	ASI|JP|JA046|UBE
Japan	Ueda, JP	ASI|JP|JA026|UEDA
Japan	Uji, JP	ASI|JP|JA022|UJI
Japan	Urasoe, JP	ASI|JP|JA032|URASOE
Japan	Urawa, JP	ASI|JP|JA035|URAWA
Japan	Urayasu, JP	ASI|JP|JA041|URAYASU
Japan	Utsunomiya, JP	ASI|JP|JA039|UTSUNOMIYA
Japan	Wakayama, JP	ASI|JP|JA044|WAKAYAMA
Japan	Yachiyo, JP	ASI|JP|JA012|YACHIYO
Japan	Yaizu, JP	ASI|JP|JA038|YAIZU
Japan	Yamagata, JP	ASI|JP|JA045|YAMAGATA
Japan	Yamaguchi, JP	ASI|JP|JA046|YAMAGUCHI
Japan	Yamato, JP	ASI|JP|JA028|YAMATO
Japan	Yao, JP	ASI|JP|JA033|YAO
Japan	Yatsushiro, JP	ASI|JP|JA021|YATSUSHIRO
Japan	Yokkaichi, JP	ASI|JP|JA030|YOKKAICHI
Japan	Yokohama, JP	ASI|JP|JA019|YOKOHAMA
Japan	Yokosuka, JP	ASI|JP|JA019|YOKOSUKA
Japan	Yonago, JP	ASI|JP|JA042|YONAGO
Japan	Zama, JP	ASI|JP|JA019|ZAMA
Jordan	Amman, JO	MEA|JO|JO002|AMMAN
Jordan	Irbid, JO	MEA|JO|JO009|IRBID
Kazakhstan	Aktau, KZ	ASI|KZ|KZ000|AKTAU
Kazakhstan	Aktobe, KZ	ASI|KZ|KZ000|AKTOBE
Kazakhstan	Almaty, KZ	ASI|KZ|KZ001|ALMATY

Kazakhstan	Astana, KZ	ASI|KZ|KZ004|ASTANA
Kazakhstan	Ekibastuz, KZ	ASI|KZ|KZ010|EKIBASTUZ
Kazakhstan	Ist-Kamenogorsk, KZ	ASI|KZ|KZ014|IST-KAMENOGORSK
Kazakhstan	Karaganda, KZ	ASI|KZ|KZ000|KARAGANDA
Kazakhstan	Kustanai, KZ	ASI|KZ|KZ012|KUSTANAI
Kazakhstan	Kyzylorda, KZ	ASI|KZ|KZ013|KYZYLORDA
Kazakhstan	Pavlodar, KZ	ASI|KZ|KZ010|PAVLODAR
Kazakhstan	Petropavlovsk, KZ	ASI|KZ|KZ015|PETROPAVLOVSK
Kazakhstan	Semipalatinsk, KZ	ASI|KZ|KZ014|SEMIPALATINSK
Kazakhstan	Taraz, KZ	ASI|KZ|KZ016|TARAZ
Kazakhstan	Temirtau, KZ	ASI|KZ|KZ011|TEMIRTAU
Kazakhstan	Uralsk, KZ	ASI|KZ|KZ006|URALSK
Kenya	Eldoret, KE	AFR|KE|KE007|ELDORET
Kenya	Kisumu, KE	AFR|KE|KE006|KISUMU
Kenya	Kitale, KE	AFR|KE|KE007|KITALE
Kenya	Machakos, KE	AFR|KE|KE003|MACHAKOS
Kenya	Malindi, KE	AFR|KE|KE002|MALINDI
Kenya	Mombasa, KE	AFR|KE|KE002|MOMBASA
Kenya	Nairobi, KE	AFR|KE|KE004|NAIROBI
Kenya	Nakuru, KE	AFR|KE|KE007|NAKURU
Kenya	Nanyuki, KE	AFR|KE|KE007|NANYUKI
Kinshasa	Boma, CD	AFR|CD|CG002|BOMA
Kinshasa	Bukavu, CD	AFR|CD|CG011|BUKAVU
Kinshasa	Kananga, CD	AFR|CD|CG004|KANANGA
Kinshasa	Kikwit, CD	AFR|CD|CG001|KIKWIT
Kinshasa	Kisangani, CD	AFR|CD|CG010|KISANGANI
Kinshasa	Kolwezi, CD	AFR|CD|CG006|KOLWEZI
Kinshasa	Likasi, CD	AFR|CD|CG006|LIKASI
Kinshasa	Lubumbashi, CD	AFR|CD|CG006|LUBUMBASHI
Kinshasa	Matadi, CD	AFR|CD|CG002|MATADI
Kinshasa	Mbandaka, CD	AFR|CD|CG003|MBANDAKA
Kinshasa	Mbuji-Mayi, CD	AFR|CD|CG005|MBUJI-MAYI
Kiribati	Tarawa, KI	OCN|KI|KR000|TARAWA
Kuwait	As Salimiyah, KW	MEA|KW|KU000|AS SALIMIYAH
Kuwait	Jalib as-Suyuh, KW	MEA|KW|KU000|JALIB AS-SUYUH
Kuwait	Kuwait City, KW	MEA|KW|KU000|KUWAIT CITY
Kyrgyzstan	Bishkek, KG	ASI|KG|KG002|BISHKEK
Kyrgyzstan	Osh, KG	ASI|KG|KG006|OSH
Laos	Luang Prabang, LA	ASI|LA|LA008|LUANG PRABANG
Laos	Vientiane, LA	ASI|LA|LA017|VIENTIANE
Latvia	Daugavpils, LV	EUR|LV|LG006|DAUGAVPILS
Latvia	Riga, LV	EUR|LV|LG026|RIGA
Lebanon	Beirut, LB	MEA|LB|LE002|BEIRUT

Lebanon	Jbeil, LB	MEA|LB|LE005|JBEIL
Lebanon	Sidon, LB	MEA|LB|LE000|SIDON
Lebanon	Tripoli, LB	MEA|LB|LE003|TRIPOLI
Lebanon	Tyre, LB	MEA|LB|LE000|TYRE
Lesotho	Maseru, LS	AFR|LS|LT000|MASERU
Liberia	Monrovia, LR	AFR|LR|LI007|MONROVIA
Libya	Al Khums, LY	AFR|LY|LY006|AL KHUMS
Libya	Benghazi, LY	AFR|LY|LY012|BENGHAZI
Libya	Misurata, LY	AFR|LY|LY016|MISURATA
Libya	Sebha, LY	AFR|LY|LY018|SEBHA
Libya	Tripoli, LY	AFR|LY|LY021|TRIPOLI
Libya	Zuwarah, LY	AFR|LY|LY008|ZUWARAH
Liechtenstein	Vaduz, LI	EUR|LI|LS000|VADUZ
Lithuania	Kaunas, LT	EUR|LT|LH013|KAUNAS
Lithuania	Klaipeda, LT	EUR|LT|LH017|KLAIPEDA
Lithuania	Panevezhis, LT	EUR|LT|LH030|PANEVEZHIS
Lithuania	Vilnius, LT	EUR|LT|LH054|VILNIUS
Macau	Macao, MO	ASI|MO|MC---|MACAO
Macedonia	Skoplje, MK	EUR|MK|MK000|SKOPLJE
Madagascar	Antananarivo, MG	AFR|MG|MA001|ANTANANARIVO
Malawi	Blantyre-Limbe, MW	AFR|MW|MI000|BLANTYRE-LIMBE
Malawi	Lilongwe, MW	AFR|MW|MI000|LILONGWE
Malaysia	Alor Setar, MY	ASI|MY|MY002|ALOR SETAR
Malaysia	George Town, MY	ASI|MY|MY010|GEORGE TOWN
Malaysia	Ipoh, MY	ASI|MY|MY008|IPOH
Malaysia	Johore Bharu, MY	ASI|MY|MY001|JOHORE BHARU
Malaysia	Klang, MY	ASI|MY|MY013|KLANG
Malaysia	Kota Bahru, MY	ASI|MY|MY003|KOTA BAHRU
Malaysia	Kota Kinabalu, MY	ASI|MY|MY011|KOTA KINABALU
Malaysia	Kuala Lumpur, MY	ASI|MY|MY015|KUALA LUMPUR
Malaysia	Kuala Terengganu, MY	ASI|MY|MY014|KUALA TERENGGANU
Malaysia	Kuantan, MY	ASI|MY|MY007|KUANTAN
Malaysia	Kuching, MY	ASI|MY|MY012|KUCHING
Malaysia	Petaling Jaya, MY	ASI|MY|MY000|PETALING JAYA
Malaysia	Sandakan, MY	ASI|MY|MY011|SANDAKAN
Malaysia	Seremban, MY	ASI|MY|MY006|SEREMBAN
Malaysia	Shah Alam, MY	ASI|MY|MY000|SHAH ALAM
Malaysia	Sibu, MY	ASI|MY|MY012|SIBU
Malaysia	Sungai Petani, MY	ASI|MY|MY002|SUNGAI PETANI
Malaysia	Taiping, MY	ASI|MY|MY008|TAIPING
Maldives	Male, MV	ASI|MV|MV012|MALE
Mali	Bamako, ML	AFR|ML|ML000|BAMAKO
Mali	Timbuktu, ML	AFR|ML|ML000|TIMBUKTU

Malta	Valletta, MT	EUR|MT|MT---|VALLETTA
Martinique	Fort-De-France, MQ	CAC|MQ|MB---|FORT-DE-FRANCE
Mauritania	Nouakchott, MR	AFR|MR|MR005|NOUAKCHOTT
Mauritius	Beau Bassin, MU	AFR|MU|MP008|BEAU BASSIN
Mauritius	Port Louis, MU	AFR|MU|MP009|PORT LOUIS
Mexico	Acapulco, MX	NAM|MX|MX012|ACAPULCO
Mexico	Aguascalientes, MX	NAM|MX|MX001|AGUASCALIENTES
Mexico	Ahome, MX	NAM|MX|MX025|AHOME
Mexico	Benito Juarez-Cancun-Qroo, MX	NAM|MX|MX023|BENITO JUAREZ-CANCUN-QROO
Mexico	Cajeme, MX	NAM|MX|MX026|CAJEME
Mexico	Campeche, MX	NAM|MX|MX004|CAMPECHE
Mexico	Celaya, MX	NAM|MX|MX011|CELAYA
Mexico	Centro, MX	NAM|MX|MX010|CENTRO
Mexico	Chihuahua, MX	NAM|MX|MX006|CHIHUAHUA
Mexico	Ciudad Madero, MX	NAM|MX|MX028|CIUDAD MADERO
Mexico	Ciudad Victoria, MX	NAM|MX|MX002|CIUDAD VICTORIA
Mexico	Coatzacoalcos, MX	NAM|MX|MX030|COATZACOALCOS
Mexico	Colimas, MX	NAM|MX|MX019|COLIMAS
Mexico	Cordoba, MX	NAM|MX|MX030|CÓRDOBA
Mexico	Cuernavaca, MX	NAM|MX|MX017|CUERNAVACA
Mexico	Culican, MX	NAM|MX|MX025|CULIACÁN
Mexico	Durango, MX	NAM|MX|MX010|DURANGO
Mexico	Ecatepec, MX	NAM|MX|MX015|ECATEPEC
Mexico	Ensenada, MX	NAM|MX|MX002|ENSENADA
Mexico	Gomez Palacio, MX	NAM|MX|MX010|GÓMEZ PALACIO
Mexico	Guadalajara, MX	NAM|MX|MX014|GUADALAJARA
Mexico	Guadalupe, MX	NAM|MX|MX005|GUADALUPE
Mexico	Hermosillo, MX	NAM|MX|MX002|HERMOSILLO
Mexico	Irapuato, MX	NAM|MX|MX011|IRAPUATO
Mexico	Jalapa, MX	NAM|MX|MX027|JALAPA
Mexico	Juarez, MX	NAM|MX|MX015|CIUDAD JUÁREZ
Mexico	La Paz, MX	NAM|MX|MX003|LA PAZ
Mexico	Leon, MX	NAM|MX|MX011|LEÓN
Mexico	Lopez Mateos, MX	NAM|MX|MX015|CIUDAD LÓPEZ MATEOS
Mexico	Los Mochis, MX	NAM|MX|MX025|LOS MOCHIS
Mexico	Matamoros, MX	NAM|MX|MX028|MATAMOROS
Mexico	Mazatlan, MX	NAM|MX|MX025|MAZATLÁN
Mexico	Merida, MX	NAM|MX|MX002|MÉRIDA
Mexico	Mexicali, MX	NAM|MX|MX002|MEXICALI
Mexico	Mexico City, MX	NAM|MX|MX009|MEXICO CITY
Mexico	Minatitlan, MX	NAM|MX|MX030|MINATITLÁN

Mexico	Monclova, MX	NAM|MX|MX007|MONCLOVA
Mexico	Monterrey, MX	NAM|MX|MX005|MONTERREY
Mexico	Morelia, MX	NAM|MX|MX016|MORELIA
Mexico	Naucalpan, MX	NAM|MX|MX015|NAUCALPAN
Mexico	Netzahualcoyotl, MX	NAM|MX|MX027|NETZAHUALCÓYOTL
Mexico	Nogales, MX	NAM|MX|MX030|NOGALES
Mexico	Nuevo Laredo, MX	NAM|MX|MX028|NUEVO LAREDO
Mexico	Oaxaca, MX	NAM|MX|MX020|OAXACA DE JUÁREZ
Mexico	Obregon, MX	NAM|MX|MX026|CIUDAD OBREGÓN
Mexico	Orizaba, MX	NAM|MX|MX030|ORIZABA
Mexico	Pachuca, MX	NAM|MX|MX013|PACHUCA
Mexico	Poza Rica De Hidalgo, MX	NAM|MX|MX030|POZA RICA DE HIDALGO
Mexico	Puebla De Zaragoza, MX	NAM|MX|MX021|PUEBLA DE ZARAGOZA
Mexico	Queretaro, MX	NAM|MX|MX022|QUERÉTARO
Mexico	Reynosa, MX	NAM|MX|MX028|REYNOSA
Mexico	Salamanca, MX	NAM|MX|MX011|SALAMANCA
Mexico	Saltillo, MX	NAM|MX|MX007|SALTILLO
Mexico	San Luis Potosi, MX	NAM|MX|MX024|SAN LUIS POTOSÍ
Mexico	Tampico, MX	NAM|MX|MX028|TAMPICO
Mexico	Tapachula, MX	NAM|MX|MX005|TAPACHULA
Mexico	Tehuacan, MX	NAM|MX|MX021|TEHUACÁN
Mexico	Tepic, MX	NAM|MX|MX018|TEPIC
Mexico	Tijuana, MX	NAM|MX|MX002|TIJUANA
Mexico	Tlalnepantla, MX	NAM|MX|MX015|TLALNEPANTLA
Mexico	Tlalpan, MX	NAM|MX|MX009|TLALPAN
Mexico	Tlaquepaque, MX	NAM|MX|MX014|TLAQUEPAQUE
Mexico	Tlaxcala, MX	NAM|MX|MX029|TLAXCALA
Mexico	Toluca, MX	NAM|MX|MX015|TOLUCA
Mexico	Torreon, MX	NAM|MX|MX006|TORREÓN
Mexico	Uruapan, MX	NAM|MX|MX016|URUAPAN
Mexico	Veracruz Llave, MX	NAM|MX|MX030|VERACRUZ LLAVE
Mexico	Villahermosa, MX	NAM|MX|MX027|VILLAHERMOSA
Mexico	Xochimilco, MX	NAM|MX|MX009|XOCHIMILCO
Mexico	Zacatecas, MX	NAM|MX|MX032|ZACATECAS
Mexico	Zamora De Hidalgo, MX	NAM|MX|MX016|ZAMORA DE HIDALGO
Mexico	Zapopan, MX	NAM|MX|MX014|ZAPOPAN
Moldova	Beltsy, MD	EUR|MD|MD000|BELTSY
Moldova	Kishinev, MD	EUR|MD|MD000|KISHINEV
Monaco	Monaco, MC	EUR|MC|MN000|MONACO
Mongolia	Ulaanbaatar, MN	ASI|MN|MG021|ULAANBAATAR
Montenegro	Podgorica, CS	EUR|CS|YI002|PODGORICA
Montserrat	Plymouth, MS	CAC|MS|MH001|PLYMOUTH

Morocco	Agadir, MA	AFR|MA|MO041|AGADIR
Morocco	Beni Mellal, MA	AFR|MA|MO006|BÉNI-MELLAL
Morocco	Casablanca, MA	AFR|MA|MO008|CASABLANCA
Morocco	El Jadida, MA	AFR|MA|MO010|EL JADIDA
Morocco	Fes, MA	AFR|MA|MO016|FÈS
Morocco	Kenitra, MA	AFR|MA|MO019|KÉNITRA
Morocco	Khouribga, MA	AFR|MA|MO022|KHOURIBGA
Morocco	Marrakech, MA	AFR|MA|MO025|MARRAKECH
Morocco	Meknes, MA	AFR|MA|MO026|MEKNÈS
Morocco	Oujda, MA	AFR|MA|MO029|OUJDA
Morocco	Rabat, MA	AFR|MA|MO030|RABAT
Morocco	Safi, MA	AFR|MA|MO031|SAFI
Morocco	Sale, MA	AFR|MA|MO030|SALÉ
Morocco	Tanger, MA	AFR|MA|MO035|TANGER
Morocco	Tetouan, MA	AFR|MA|MO040|TÉTOUAN
Mozambique	Beira, MZ	AFR|MZ|MZ008|BEIRA
Mozambique	Bilene, MZ	AFR|MZ|MZ002|BILENE
Mozambique	Chidenguele, MZ	AFR|MZ|MZ002|CHIDENGUELE
Mozambique	Chimoio/Beira Corridor, MZ	AFR|MZ|MZ004|CHIMOIO/BEIRA CORRIDOR
Mozambique	Inhaca Island, MZ	AFR|MZ|MZ005|INHACA ISLAND
Mozambique	Inhambane, MZ	AFR|MZ|MZ003|INHAMBANE
Mozambique	Inhasoro, MZ	AFR|MZ|MZ003|INHASORO
Mozambique	Lichinga, MZ	AFR|MZ|MZ007|LICHINGA
Mozambique	Maputo, MZ	AFR|MZ|MZ005|MAPUTO
Mozambique	Mozambique Island, MZ	AFR|MZ|MZ006|MOZAMBIQUE ISLAND
Mozambique	Nacala, MZ	AFR|MZ|MZ006|NACALA
Mozambique	Nampula, MZ	AFR|MZ|MZ006|NAMPULA
Mozambique	Pemba, MZ	AFR|MZ|MZ001|PEMBA
Mozambique	Ponta do Ouro, MZ	AFR|MZ|MZ005|PONTA DO OURO
Mozambique	Quelimane, MZ	AFR|MZ|MZ010|QUELIMANE
Mozambique	Vilanculos, MZ	AFR|MZ|MZ003|VILANCULOS
Mozambique	Xai Xai, MZ	AFR|MZ|MZ002|XAI XAI
Namibia	Windhoek, NA	AFR|NA|WA005|WINDHOEK
Nepal	Biratnagar, NP	ASI|NP|NP000|BIRATNAGAR
Nepal	Kathmandu, NP	ASI|NP|NP000|KATHMANDU
Nepal	Lalitpur, NP	ASI|NP|NP000|LALITPUR
Netherlands Antilles	Willemstad, AN	CAC|AN|NT---|WILLEMSTAD
Netherlands	Almere, NL	EUR|NL|NL002|ALMERE
Netherlands	Amersfoort, NL	EUR|NL|NL010|AMERSFOORT
Netherlands	Amsterdam, NL	EUR|NL|NL008|AMSTERDAM
Netherlands	Apeldoorn, NL	EUR|NL|NL004|APELDOORN

Netherlands	Arnhem, NL	EUR|NL|NL004|ARNHEM
Netherlands	Breda, NL	EUR|NL|NL007|BREDA
Netherlands	Dordrecht, NL	EUR|NL|NL012|DORDRECHT
Netherlands	Ede, NL	EUR|NL|NL004|EDE
Netherlands	Eindhoven, NL	EUR|NL|NL007|EINDHOVEN
Netherlands	Emmen, NL	EUR|NL|NL001|EMMEN
Netherlands	Enschede, NL	EUR|NL|NL009|ENSCHEDE
Netherlands	Geleen-Sittard, NL	EUR|NL|NL006|GELEEN-SITTARD
Netherlands	Groningen, NL	EUR|NL|NL005|GRONINGEN
Netherlands	Haarlem, NL	EUR|NL|NL008|HAARLEM
Netherlands	Haarlemmermeer, NL	EUR|NL|NL008|HAARLEMMERMEER
Netherlands	Heerlen-Kerkrade, NL	EUR|NL|NL006|HEERLEN-KERKRADE
Netherlands	Leiden, NL	EUR|NL|NL012|LEIDEN
Netherlands	Maastricht, NL	EUR|NL|NL006|MAASTRICHT
Netherlands	Nijmegen, NL	EUR|NL|NL004|NIJMEGEN
Netherlands	Rotterdam, NL	EUR|NL|NL012|ROTTERDAM
Netherlands	S-Gravenhage, NL	EUR|NL|NL012|S-GRAVENHAGE
Netherlands	S-Hertogenbosch, NL	EUR|NL|NL007|S-HERTOGENBOSCH
Netherlands	Tilburg, NL	EUR|NL|NL007|TILBURG
Netherlands	Utrecht, NL	EUR|NL|NL010|UTRECHT
Netherlands	Zaanstad, NL	EUR|NL|NL008|ZAANSTAD
Netherlands	Zoetermeer, NL	EUR|NL|NL012|ZOETERMEER
Netherlands	Zwolle, NL	EUR|NL|NL009|ZWOLLE
New Caledonia	Noumea, NC	OCN|NC|NC000|NOUMEA
New Zealand	Auckland, NZ	OCN|NZ|NZ000|AUCKLAND
New Zealand	Christchurch, NZ	OCN|NZ|NZ000|CHRISTCHURCH
New Zealand	Dunedin, NZ	OCN|NZ|NZ000|DUNEDIN
New Zealand	Hamilton, NZ	OCN|NZ|NZ000|HAMILTON
New Zealand	Manukau, NZ	OCN|NZ|NZ000|MANUKAU
New Zealand	Napier-Hastings, NZ	OCN|NZ|NZ000|NAPIER-HASTINGS
New Zealand	Northshore, NZ	OCN|NZ|NZ000|NORTHSHORE
New Zealand	Waitakere, NZ	OCN|NZ|NZ000|WAITAKERE
New Zealand	Wellington, NZ	OCN|NZ|NZ000|WELLINGTON
Nicaragua	Chinandega, NI	CAC|NI|NU003|CHINANDEGA
Nicaragua	Granada, NI	CAC|NI|NU006|GRANADA
Nicaragua	Leon, NI	CAC|NI|NU008|LEON
Nicaragua	Managua, NI	CAC|NI|NU010|MANAGUA
Nicaragua	Masaya, NI	CAC|NI|NU011|MASAYA
Niger	Maradi, NE	AFR|NE|NG004|MARADI
Niger	Niamey, NE	AFR|NE|NG005|NIAMEY
Niger	Zinder, NE	AFR|NE|NG008|ZINDER
Nigeria	Aba, NG	AFR|NG|NI008|ABA
Nigeria	Abeokuta, NG	AFR|NG|NI000|ABEOKUTA

Nigeria	Abuja, NG	AFR|NG|NI000|ABUJA
Nigeria	Ado-Ekiti, NG	AFR|NG|NI000|ADO-EKITI
Nigeria	Calabar, NG	AFR|NG|NI000|CALABAR
Nigeria	Ede, NG	AFR|NG|NI000|EDE
Nigeria	Enugu, NG	AFR|NG|NI000|ENUGU
Nigeria	Ibadan, NG	AFR|NG|NI029|IBADAN
Nigeria	Ife, NG	AFR|NG|NI000|IFE
Nigeria	Ikere-Ekiti, NG	AFR|NG|NI000|IKERE-EKITI
Nigeria	Ila, NG	AFR|NG|NI000|ILA
Nigeria	Ilesha, NG	AFR|NG|NI000|ILESHA
Nigeria	Ilorin, NG	AFR|NG|NI000|ILORIN
Nigeria	Iwo, NG	AFR|NG|NI000|IWO
Nigeria	Kaduna, NG	AFR|NG|NI019|KADUNA
Nigeria	Kano, NG	AFR|NG|NI020|KANO
Nigeria	Lagos, NG	AFR|NG|NI024|LAGOS
Nigeria	Maiduguri, NG	AFR|NG|NI000|MAIDUGURI
Nigeria	Mushin, NG	AFR|NG|NI024|MUSHIN
Nigeria	Ogbomosho, NG	AFR|NG|NI000|OGBOMOSHO
Nigeria	Onitsha, NG	AFR|NG|NI000|ONITSHA
Nigeria	Oshogbo, NG	AFR|NG|NI000|OSHOGBO
Nigeria	Oyo, NG	AFR|NG|NI029|OYO
Nigeria	Port Harcourt, NG	AFR|NG|NI031|PORT HARCOURT
Nigeria	Zaria, NG	AFR|NG|NI000|ZARIA
North Korea	Chechon, KP	ASI|KP|KN000|CHECHON
North Korea	Chejung, KP	ASI|KP|KN000|CHEJUNG
North Korea	Haeju, KP	ASI|KP|KN005|HAEJU
North Korea	Hamhung, KP	ASI|KP|KN003|HAMHUNG
North Korea	Hyesan, KP	ASI|KP|KN013|HYESAN
North Korea	Inchon, KP	ASI|KP|KN007|INCHON
North Korea	Kaesong, KP	ASI|KR|KS001|KAESONG
North Korea	Kanggye, KP	ASI|KP|KN001|KANGGYE
North Korea	Pyongyang, KP	ASI|KP|KN000|PYONGYANG
North Korea	Sariwon, KP	ASI|KP|KN004|SARIWON
North Korea	Taejon, KP	ASI|KP|KN010|TAEJON
North Korea	Wonsan, KP	ASI|KR|KS009|WONSAN
Norway	Aalesund, NO	EUR|NO|NO007|AALESUND
Norway	Arendal, NO	EUR|NO|NO002|ARENDAL
Norway	Bergen, NO	EUR|NO|NO006|BERGEN
Norway	Bodoe, NO	EUR|NO|NO009|BODOE
Norway	Drammen, NO	EUR|NO|NO003|DRAMMEN
Norway	Fredrikstad, NO	EUR|NO|NO012|FREDRIKSTAD
Norway	Geilo, NO	EUR|NO|NO003|GEILO
Norway	Hammerfest, NO	EUR|NO|NO004|HAMMERFEST

Norway	Haugesund, NO	EUR|NO|NO013|HAUGESUND
Norway	Hemsedal, NO	EUR|NO|NO003|HEMSEDAL
Norway	Hoenefoss, NO	EUR|NO|NO003|HOENEFOSS
Norway	Krageroe, NO	EUR|NO|NO016|KRAGEROE
Norway	Kristiansand, NO	EUR|NO|NO018|KRISTIANSAND
Norway	Kristiansund, NO	EUR|NO|NO007|KRISTIANSUND
Norway	Larvik, NO	EUR|NO|NO019|LARVIK
Norway	Lillehammer, NO	EUR|NO|NO010|LILLEHAMMER
Norway	Lofoten, NO	EUR|NO|NO009|LOFOTEN
Norway	Molde, NO	EUR|NO|NO007|MOLDE
Norway	Oslo, NO	EUR|NO|NO011|OSLO
Norway	Stavanger, NO	EUR|NO|NO013|STAVANGER
Norway	Toensberg, NO	EUR|NO|NO019|TOENSBERG
Norway	Tromsoe, NO	EUR|NO|NO017|TROMSOE
Norway	Trondheim, NO	EUR|NO|NO015|TRONDHEIM
Norway	Trysil, NO	EUR|NO|NO005|TRYSIL
Oman	Muscat, OM	MEA|OM|MU006|MUSCAT
Pakistan	Bahawalnagar, PK	ASI|PK|PK007|BAHAWALNAGAR
Pakistan	Burewala, PK	ASI|PK|PK007|BUREWALA
Pakistan	Chiniot, PK	ASI|PK|PK007|CHINIOT
Pakistan	Dadu, PK	ASI|PK|PK008|DADU
Pakistan	Daska, PK	ASI|PK|PK007|DASKA
Pakistan	Dera Ghazi Khan, PK	ASI|PK|PK007|DERA GHAZI KHAN
Pakistan	Faisalabad, PK	ASI|PK|PK007|FAISALABAD
Pakistan	Gojra, PK	ASI|PK|PK007|GOJRA
Pakistan	Gujranwala, PK	ASI|PK|PK007|GUJRANWALA
Pakistan	Gujrat, PK	ASI|PK|PK007|GUJRAT
Pakistan	Hafizabad, PK	ASI|PK|PK007|HAFIZABAD
Pakistan	Hyderabad, PK	ASI|PK|PK007|HYDERABAD
Pakistan	Islamabad, PK	ASI|PK|PK004|ISLAMABAD
Pakistan	Jacobabad, PK	ASI|PK|PK008|JACOBABAD
Pakistan	Jaranwala, PK	ASI|PK|PK007|JARANWALA
Pakistan	Jhang, PK	ASI|PK|PK007|JHANG
Pakistan	Jhelum, PK	ASI|PK|PK007|JHELUM
Pakistan	Kamoke, PK	ASI|PK|PK007|KAMOKE
Pakistan	Karachi, PK	ASI|PK|PK008|KARACHI
Pakistan	Kasur, PK	ASI|PK|PK007|KASUR
Pakistan	Khairpur, PK	ASI|PK|PK008|KHAIRPUR
Pakistan	Khanewal, PK	ASI|PK|PK007|KHANEWAL
Pakistan	Khanpur, PK	ASI|PK|PK007|KHANPUR
Pakistan	Kohat, PK	ASI|PK|PK005|KOHAT
Pakistan	Lahore, PK	ASI|PK|PK007|LAHORE
Pakistan	Larkana, PK	ASI|PK|PK008|LARKANA

Pakistan	Mangora, PK	ASI|PK|PK001|MANGORA
Pakistan	Mardan, PK	ASI|PK|PK005|MARDAN
Pakistan	Mirpur Khas, PK	ASI|PK|PK008|MIRPUR KHAS
Pakistan	Multan, PK	ASI|PK|PK007|MULTAN
Pakistan	Muridke, PK	ASI|PK|PK007|MURIDKE
Pakistan	Nawabshah, PK	ASI|PK|PK008|NAWABSHAH
Pakistan	Okara, PK	ASI|PK|PK007|OKARA
Pakistan	Pakpattan, PK	ASI|PK|PK007|PAKPATTAN
Pakistan	Peshawar, PK	ASI|PK|PK005|PESHAWAR
Pakistan	Quetta, PK	ASI|PK|PK002|QUETTA
Pakistan	Rahimyar Khan, PK	ASI|PK|PK007|RAHIMYAR KHAN
Pakistan	Rawalpindi, PK	ASI|PK|PK007|RAWALPINDI
Pakistan	Sadiqabad, PK	ASI|PK|PK007|SADIQABAD
Pakistan	Sahiwal, PK	ASI|PK|PK007|SAHIWAL
Pakistan	Sargodha, PK	ASI|PK|PK007|SARGODHA
Pakistan	Sukkur, PK	ASI|PK|PK008|SUKKUR
Pakistan	Tandoadam, PK	ASI|PK|PK008|TANDOADAM
Panama	Ciudad De Colon, PA	CAC|PA|PM004|CIUDAD DE COLON
Panama	Panama, PA	CAC|PA|PM008|PANAMA
Panama	San Miguelito, PA	CAC|PA|PM008|SAN MIGUELITO
Papua New Guinea	Port Moresby, PG	OCN|PG|PP013|PORT MORESBY
Paraguay	Asuncion, PY	SAM|PY|PA008|ASUNCION
Paraguay	Ciudad Del Este, PY	SAM|PY|PA001|CIUDAD DEL ESTE
Paraguay	San Lorenzo, PY	SAM|PY|PA008|SAN LORENZO
Peru	Arequipa, PE	SAM|PE|PE004|AREQUIPA
Peru	Ayacucho, PE	SAM|PE|PE005|AYACUCHO
Peru	Cajamarca, PE	SAM|PE|PE006|CAJAMARCA
Peru	Chiclayo, PE	SAM|PE|PE014|CHICLAYO
Peru	Chimbote, PE	SAM|PE|PE002|CHIMBOTE
Peru	Cuzco, PE	SAM|PE|PE008|CUZCO
Peru	Huancayo, PE	SAM|PE|PE012|HUANCAYO
Peru	Huanuco, PE	SAM|PE|PE010|HUÁNUCO
Peru	Ica, PE	SAM|PE|PE011|ICA
Peru	Iquitos, PE	SAM|PE|PE016|IQUITOS
Peru	Juliaca, PE	SAM|PE|PE021|JULIACA
Peru	Lima, PE	SAM|PE|PE015|LIMA
Peru	Piura, PE	SAM|PE|PE020|PIURA
Peru	Pucallpa, PE	SAM|PE|PE025|PUCALLPA
Peru	Sullana, PE	SAM|PE|PE020|SULLANA
Peru	Tacna, PE	SAM|PE|PE023|TACNA
Peru	Trujillo, PE	SAM|PE|PE013|TRUJILLO
Philippines	Angeles, PH	ASI|PH|RP006|ANGELES

Philippines	Bacolod, PH	ASI|PH|RP000|BACOLOD
Philippines	Bago, PH	ASI|PH|RP010|BAGO
Philippines	Baguio, PH	ASI|PH|RP011|BAGUIO
Philippines	Batangas, PH	ASI|PH|RP016|BATANGAS
Philippines	Butuan, PH	ASI|PH|RP022|BUTUAN
Philippines	Cabanatuan, PH	ASI|PH|RP023|CABANATUAN
Philippines	Cadiz, PH	ASI|PH|RP024|CADIZ
Philippines	Cagayan De Oro, PH	ASI|PH|RP026|CAGAYAN DE ORO
Philippines	Calbayog, PH	ASI|PH|RP027|CALBAYOG
Philippines	Caloocan, PH	ASI|PH|RP028|CALOOCAN
Philippines	Cebu, PH	ASI|PH|RP037|CEBU
Philippines	Cotabato, PH	ASI|PH|RP039|COTABATO
Philippines	Dagupan, PH	ASI|PH|RP040|DAGUPAN
Philippines	Davao, PH	ASI|PH|RP133|DAVAO
Philippines	General Santos, PH	ASI|PH|RP049|GENERAL SANTOS
Philippines	Iligan, PH	ASI|PH|RP052|ILIGAN
Philippines	Iloilo, PH	ASI|PH|RP055|ILOILO
Philippines	Legaspi, PH	ASI|PH|RP067|LEGASPI
Philippines	Lipa, PH	ASI|PH|RP069|LIPA
Philippines	Lucena City, PH	ASI|PH|RP070|LUCENA CITY
Philippines	Makati, PH	ASI|PH|RP077|MAKATI
Philippines	Mandaluyong, PH	ASI|PH|RP035|MANDALUYONG
Philippines	Mandaue, PH	ASI|PH|RP072|MANDAUE
Philippines	Manila, PH	ASI|PH|RP073|MANILA
Philippines	Marawi, PH	ASI|PH|RP074|MARAWI
Philippines	Muntinlupa, PH	ASI|PH|RP103|MUNTINLUPA
Philippines	Naga, PH	ASI|PH|RP082|NAGA
Philippines	Olongapo, PH	ASI|PH|RP089|OLONGAPO
Philippines	Ormoc, PH	ASI|PH|RP090|ORMOC
Philippines	Ozamis, PH	ASI|PH|RP092|OZAMIS
Philippines	Pagadian, PH	ASI|PH|RP093|PAGADIAN
Philippines	Pasay, PH	ASI|PH|RP098|PASAY
Philippines	Pasig, PH	ASI|PH|RP103|PASIG
Philippines	Puerto Princesa, PH	ASI|PH|RP099|PUERTO PRINCESA
Philippines	Quezon City, PH	ASI|PH|RP100|QUEZON CITY
Philippines	Roxas, PH	ASI|PH|RP027|ROXAS
Philippines	San Carlos, PH	ASI|PH|RP107|SAN CARLOS
Philippines	San Pablo, PH	ASI|PH|RP110|SAN PABLO
Philippines	Silay, PH	ASI|PH|RP111|SILAY
Philippines	Surigao, PH	ASI|PH|RP118|SURIGAO
Philippines	Tacloban, PH	ASI|PH|RP121|TACLOBAN
Philippines	Toledo, PH	ASI|PH|RP127|TOLEDO
Philippines	Zamboanga, PH	ASI|PH|RP130|ZAMBOANGA

Pitcairn Islands	Adamstown, PN	OCN|PN|PC---|ADAMSTOWN
Poland	Bialystok, PL	EUR|PL|PL010|BIALYSTOK
Poland	Bielsko-Biala, PL	EUR|PL|PL012|BIELSKO-BIALA
Poland	Bydgoszcz, PL	EUR|PL|PL002|BYDGOSZCZ
Poland	Bytom, PL	EUR|PL|PL012|BYTOM
Poland	Chorzow, PL	EUR|PL|PL012|CHORZÓW
Poland	Czestochowa, PL	EUR|PL|PL012|CZESTOCHOWA
Poland	Dabrowa Gornicza, PL	EUR|PL|PL012|DABROWA GÓRNICZA
Poland	Elblag, PL	EUR|PL|PL014|ELBLAG
Poland	Gdansk, PL	EUR|PL|PL011|GDANSK
Poland	Gdynia, PL	EUR|PL|PL011|GDYNIA
Poland	Gliwice, PL	EUR|PL|PL012|GLIWICE
Poland	Gorzow Wielkopolski, PL	EUR|PL|PL005|GORZÓW WIELKOPOLSKI
Poland	Jastrzebie, PL	EUR|PL|PL012|JASTRZEBIE-ZDRÓJ
Poland	Kalisz, PL	EUR|PL|PL015|KALISZ
Poland	Katowice, PL	EUR|PL|PL012|KATOWICE
Poland	Kielce, PL	EUR|PL|PL013|KIELCE
Poland	Koszalin, PL	EUR|PL|PL016|KOSZALIN
Poland	Krakow, PL	EUR|PL|PL006|KRAKÓW
Poland	Legnica, PL	EUR|PL|PL001|LEGNICA
Poland	Lodz, PL	EUR|PL|PL003|LÓDZ
Poland	Lublin, PL	EUR|PL|PL004|LUBLIN
Poland	Olsztyn, PL	EUR|PL|PL014|OLSZTYN
Poland	Opole, PL	EUR|PL|PL008|OPOLE
Poland	Plock, PL	EUR|PL|PL007|PLOCK
Poland	Poznan, PL	EUR|PL|PL015|POZNAN
Poland	Radom, PL	EUR|PL|PL007|RADOM
Poland	Ruda Slaska, PL	EUR|PL|PL012|RUDA SLASKA
Poland	Rybnik, PL	EUR|PL|PL012|RYBNIK
Poland	Rzeszow, PL	EUR|PL|PL009|RZESZÓW
Poland	Slupsk, PL	EUR|PL|PL011|SLUPSK
Poland	Sosnowiec, PL	EUR|PL|PL012|SOSNOWIEC
Poland	Szczecin, PL	EUR|PL|PL016|SZCZECIN
Poland	Tarnow, PL	EUR|PL|PL004|TARNÓW
Poland	Torun, PL	EUR|PL|PL007|TORUN
Poland	Tychy, PL	EUR|PL|PL012|TYCHY
Poland	Walbrzych, PL	EUR|PL|PL001|WALBRZYCH
Poland	Warszawa, PL	EUR|PL|PL007|WARSZAWA
Poland	Wloclawek, PL	EUR|PL|PL002|WLOCLAWEK
Poland	Wroclaw, PL	EUR|PL|PL001|WROCLAW
Poland	Zabrze, PL	EUR|PL|PL012|ZABRZE
Poland	Zielona Gora, PL	EUR|PL|PL005|ZIELONA GÓRA
Portugal	Amadora, PT	EUR|PT|PO012|AMADORA

Portugal	Castelo Branco, PT	EUR|PT|PO006|CASTELO BRANCO
Portugal	Coimbra, PT	EUR|PT|PO007|COIMBRA
Portugal	Évora, PT	EUR|PT|PO008|ÉVORA
Portugal	Faro, PT	EUR|PT|PO009|FARO
Portugal	Funchal, PT	EUR|PT|PO013|FUNCHAL
Portugal	Guarda, PT	EUR|PT|PO010|GUARDA
Portugal	Leiria, PT	EUR|PT|PO011|LEIRIA
Portugal	Lisbon, PT	EUR|PT|PO012|LISBOA
Portugal	Ponta Delgada, PT	EUR|PT|PO002|PONTA DELGADA
Portugal	Portalegre, PT	EUR|PT|PO014|PORTALEGRE
Portugal	Porto, PT	EUR|PT|PO015|PORTO
Portugal	Santarém, PT	EUR|PT|PO016|SANTARÉM
Portugal	Setúbal, PT	EUR|PT|PO017|SETÚBAL
Portugal	Viana do Castelo, PT	EUR|PT|PO018|VIANA DO CASTELO
Portugal	Vila Real, PT	EUR|PT|PO019|VILA REAL
Portugal	Viseu, PT	EUR|PT|PO020|VISEU
Puerto Rico	Arecibo, PR	CAC|PR|PR000|ARECIBO
Puerto Rico	Bayamon, PR	CAC|PR|PR000|BAYAMÓN
Puerto Rico	Caguas, PR	CAC|PR|PR000|CAGUAS
Puerto Rico	Carolina, PR	CAC|PR|PR000|CAROLINA
Puerto Rico	Guaynabo, PR	CAC|PR|PR000|GUAYNABO
Puerto Rico	Mayaguez, PR	CAC|PR|PR000|MAYAGÜEZ
Puerto Rico	Ponce, PR	CAC|PR|PR000|PONCE
Puerto Rico	San Juan, PR	CAC|PR|PR000|SAN JUAN
Qatar	Ar Rayyan, QA	MEA|QA|QA000|AR RAYYAN
Qatar	Doha, QA	MEA|QA|QA001|DOHA
Republic of Congo	Brazzaville, CG	AFR|CG|CF002|BRAZZAVILLE
Reunion	Saint-Denis, RE	AFR|RE|RE---|SAINT-DENIS
Romania	Arad, RO	EUR|RO|RO002|ARAD
Romania	Bacau, RO	EUR|RO|RO004|BACAU
Romania	Baia Mare, RO	EUR|RO|RO026|BAIA MARE
Romania	Botosani, RO	EUR|RO|RO007|BOTOSANI
Romania	Braila, RO	EUR|RO|RO008|BRAILA
Romania	Brasov, RO	EUR|RO|RO009|BRASOV
Romania	Bucuresti, RO	EUR|RO|RO010|BUCURESTI
Romania	Buzau, RO	EUR|RO|RO011|BUZAU
Romania	Cluj-Napoca, RO	EUR|RO|RO001|CLUJ-NAPOCA
Romania	Constanta, RO	EUR|RO|RO015|CONSTANTA
Romania	Craiova, RO	EUR|RO|RO018|CRAIOVA
Romania	Drobeta Turnu-Severin, RO	EUR|RO|RO027|DROBETA TURNU-SEVERIN
Romania	Galati, RO	EUR|RO|RO019|GALATI

Romania	Iasi, RO	EUR|RO|RO025|IASI
Romania	Oradea, RO	EUR|RO|RO005|ORADEA
Romania	Piatra Neamt, RO	EUR|RO|RO029|PIATRA NEAMT
Romania	Pitesti, RO	EUR|RO|RO003|PITESTI
Romania	Ploiesti, RO	EUR|RO|RO031|PLOIESTI
Romania	Rimnicu Vilcea, RO	EUR|RO|RO039|RIMNICU VILCEA
Romania	Satu-Mare, RO	EUR|RO|RO033|SATU-MARE
Romania	Sibiu, RO	EUR|RO|RO034|SIBIU
Romania	Suceava, RO	EUR|RO|RO035|SUCEAVA
Romania	Timisoara, RO	EUR|RO|RO037|TIMISOARA
Romania	Tirgu-Mures, RO	EUR|RO|RO028|TIRGU-MURES
Russia	Abakan, RU	ASI|RU|RS033|ABAKAN
Russia	Achinsk, RU	ASI|RU|RS041|ACHINSK
Russia	Angarsk, RU	ASI|RU|RS021|ANGARSK
Russia	Arkhangelsk, RU	ASI|RU|RS005|ARKHANGELSK
Russia	Armavir, RU	ASI|RU|RS040|ARMAVIR
Russia	Arzamas, RU	ASI|RU|RS055|ARZAMAS
Russia	Astrakhan, RU	ASI|RU|RS006|ASTRAKHAN
Russia	Balakovo, RU	ASI|RU|RS069|BALAKOVO
Russia	Balashikha, RU	ASI|RU|RS051|BALASHIKHA
Russia	Barnaul, RU	ASI|RU|RS043|BARNAUL
Russia	Belgorod, RU	ASI|RU|RS008|BELGOROD
Russia	Berezniki, RU	ASI|RU|RS062|BEREZNIKI
Russia	Biisk, RU	ASI|RU|RS003|BIISK
Russia	Biysk, RU	ASI|RU|RS003|BIYSK
Russia	Blagoveshchensk, RU	ASI|RU|RS007|BLAGOVESHCHENSK
Russia	Bratsk, RU	ASI|RU|RS021|BRATSK
Russia	Bryansk, RU	ASI|RU|RS010|BRYANSK
Russia	Cheboksary, RU	ASI|RU|RS016|CHEBOKSARY
Russia	Chelyabinsk, RU	ASI|RU|RS013|CHELYABINSK
Russia	Cherepovets, RU	ASI|RU|RS089|CHEREPOVETS
Russia	Cherkessk, RU	ASI|RU|RS029|CHERKESSK
Russia	Chita, RU	ASI|RU|RS014|CHITA
Russia	Dimitrovgrad, RU	ASI|RU|RS085|DIMITROVGRAD
Russia	Dzerzhinsk, RU	ASI|RU|RS055|DZERZHINSK
Russia	Ekaterinburg, RU	ASI|RU|RS075|EKATERINBURG
Russia	Elektrostal, RU	ASI|RU|RS051|ELEKTROSTAL
Russia	Elets, RU	ASI|RU|RS046|ELETS
Russia	Elista, RU	ASI|RU|RS026|ELISTA
Russia	Engels, RU	ASI|RU|RS069|ENGELS
Russia	Glazov, RU	ASI|RU|RS084|GLAZOV
Russia	Gorkey, RU	ASI|RU|RS055|NIZHNY NOVGOROD
Russia	Groznyi, RU	ASI|RU|RS012|GROZNYI

Russia	Irkutsk, RU	ASI|RU|RS021|IRKUTSK
Russia	Ivanovo, RU	ASI|RU|RS023|IVANOVO
Russia	Izhevsk, RU	ASI|RU|RS084|IZHEVSK
Russia	Kaliningrad, RU	ASI|RU|RS025|KALININGRAD
Russia	Kaluga, RU	ASI|RU|RS027|KALUGA
Russia	Kamenskiy, RU	ASI|RU|RS075|KAMENSK-URALSKY
Russia	Kansk, RU	ASI|RU|RS041|KANSK
Russia	Kazan, RU	ASI|RU|RS077|KAZAN
Russia	Kemerovo, RU	ASI|RU|RS031|KEMEROVO
Russia	Khabarovsk, RU	ASI|RU|RS032|KHABAROVSK
Russia	Khanty-Mansiysk, RU	ASI|RU|RS034|KHANTY-MANSIYSK
Russia	Khimki, RU	ASI|RU|RS052|KHIMKI
Russia	Kirov, RU	ASI|RU|RS035|KIROV
Russia	Kiselevsk, RU	ASI|RU|RS031|KISELEVSK
Russia	Kislovodsk, RU	ASI|RU|RS074|KISLOVODSK
Russia	Kolomna, RU	ASI|RU|RS010|KOLOMNA
Russia	Komsomolsk-Na-Amure, RU	ASI|RU|RS032|KOMSOMOLSK-NA-AMURE
Russia	Korolev, RU	ASI|RU|RS051|KOROLEV
Russia	Kostroma, RU	ASI|RU|RS039|KOSTROMA
Russia	Kovrov, RU	ASI|RU|RS087|KOVROV
Russia	Krasnodar, RU	ASI|RU|RS040|KRASNODAR
Russia	Krasnoyarsk, RU	ASI|RU|RS041|KRASNOYARSK
Russia	Kurgan, RU	ASI|RU|RS043|KURGAN
Russia	Kursk, RU	ASI|RU|RS044|KURSK
Russia	Lipetsk, RU	ASI|RU|RS046|LIPETSK
Russia	Magadan, RU	ASI|RU|RS047|MAGADAN
Russia	Magnitogorsk, RU	ASI|RU|RS013|MAGNITOGORSK
Russia	Maikop, RU	ASI|RU|RS001|MAIKOP
Russia	Makhachkala, RU	ASI|RU|RS017|MAKHACHKALA
Russia	Mezhdurechensk, RU	ASI|RU|RS031|MEZHDURECHENSK
Russia	Miass, RU	ASI|RU|RS013|MIASS
Russia	Michurinsk, RU	ASI|RU|RS076|MICHURINSK
Russia	Moscow, RU	ASI|RU|RS052|MOSKVA
Russia	Murmansk, RU	ASI|RU|RS053|MURMANSK
Russia	Murom, RU	ASI|RU|RS087|MUROM
Russia	Mytishchi, RU	ASI|RU|RS051|MYTISHCHI
Russia	Naberezhnyye Chelny, RU	ASI|RU|RS077|NABEREZHNYYE CHELNY
Russia	Nakhodka, RU	ASI|RU|RS063|NAKHODKA
Russia	Nalchik, RU	ASI|RU|RS024|NALCHIK
Russia	Naryan-Mar, RU	ASI|RU|RS054|NARYAN-MAR
Russia	Neftekamsk, RU	ASI|RU|RS007|NEFTEKAMSK
Russia	Nevinnomyssk, RU	ASI|RU|RS074|NEVINNOMYSSK

Russia	Nizhnekamsk, RU	ASI|RU|RS077|NIZHNEKAMSK
Russia	Nizhnevartovsk, RU	ASI|RU|RS034|NIZHNEVARTOVSK
Russia	Nizhniy Novgorod, RU	ASI|RU|RS055|NIZHNIY NOVGOROD
Russia	Nizhny Tagil, RU	ASI|RU|RS075|NIZHNY TAGIL
Russia	Noginsk, RU	ASI|RU|RS018|NOGINSK
Russia	Norilsk, RU	ASI|RU|RS041|NORILSK
Russia	Novocheboksarsk, RU	ASI|RU|RS016|NOVOCHEBOKSARSK
Russia	Novocherkassk, RU	ASI|RU|RS059|NOVOCHERKASSK
Russia	Novokuznetsk, RU	ASI|RU|RS031|NOVOKUZNETSK
Russia	Novomoskovsk, RU	ASI|RU|RS080|NOVOMOSKOVSK
Russia	Novorossiysk, RU	ASI|RU|RS079|NOVOROSSIYSK
Russia	Novoshakhtinsk, RU	ASI|RU|RS065|NOVOSHAKHTINSK
Russia	Novosibirsk, RU	ASI|RU|RS057|NOVOSIBIRSK
Russia	Novotroitsk, RU	ASI|RU|RS057|NOVOTROITSK
Russia	Obninsk, RU	ASI|RU|RS027|OBNINSK
Russia	Odintsovo, RU	ASI|RU|RS051|ODINTSOVO
Russia	Omsk, RU	ASI|RU|RS058|OMSK
Russia	Orekhovo-Zuevo, RU	ASI|RU|RS051|OREKHOVO-ZUEVO
Russia	Orel, RU	ASI|RU|RS062|OREL
Russia	Orenburg, RU	ASI|RU|RS059|ORENBURG
Russia	Orsk, RU	ASI|RU|RS059|ORSK
Russia	Penza, RU	ASI|RU|RS061|PENZA
Russia	Perm, RU	ASI|RU|RS062|PERM
Russia	Pervouralsk, RU	ASI|RU|RS075|PERVOURALSK
Russia	Petropavlovsk, RU	ASI|RU|RS028|PETROPAVLOVSK-KAMCHATSKY
Russia	Petrozavodsk, RU	ASI|RU|RS030|PETROZAVODSK
Russia	Podolsk, RU	ASI|RU|RS051|PODOLSK
Russia	Prokpyevsk, RU	ASI|RU|RS031|PROKPYEVSK
Russia	Pskov, RU	ASI|RU|RS064|PSKOV
Russia	Pyatigorsk, RU	ASI|RU|RS074|PYATIGORSK
Russia	Rostov-Na-Donu, RU	ASI|RU|RS065|ROSTOV-NA-DONU
Russia	Rubtsovsk, RU	ASI|RU|RS003|RUBTSOVSK
Russia	Rybinsk, RU	ASI|RU|RS079|RYBINSK
Russia	Ryzan, RU	ASI|RU|RS066|RYZAN
Russia	Saint Petersburg, RU	ASI|RU|RS073|SAINT PETERSBURG
Russia	Salavat, RU	ASI|RU|RS007|SALAVAT
Russia	Samara, RU	ASI|RU|RS068|SAMARA
Russia	Saransk, RU	ASI|RU|RS050|SARANSK
Russia	Saratov, RU	ASI|RU|RS059|SARATOV
Russia	Serpukhov, RU	ASI|RU|RS051|SERPUKHOV
Russia	Severodvinsk, RU	ASI|RU|RS005|SEVERODVINSK
Russia	Seversk, RU	ASI|RU|RS079|SEVERSK

Russia	Shakhty, RU	ASI|RU|RS065|SHAKHTY
Russia	Shchelkovo, RU	ASI|RU|RS051|SHCHELKOVO
Russia	Smolensk, RU	ASI|RU|RS072|SMOLENSK
Russia	Sochi, RU	ASI|RU|RS040|SOCHI
Russia	Solikamsk, RU	ASI|RU|RS062|SOLIKAMSK
Russia	Stary Oskol , RU	ASI|RU|RS008|STARY OSKOL
Russia	Stavropol, RU	ASI|RU|RS074|STAVROPOL
Russia	Sterlitamak, RU	ASI|RU|RS041|STERLITAMAK
Russia	Surgut, RU	ASI|RU|RS068|SURGUT
Russia	Syktyvkar, RU	ASI|RU|RS036|SYKTYVKAR
Russia	Syzran, RU	ASI|RU|RS085|SYZRAN
Russia	Taganrog, RU	ASI|RU|RS065|TAGANROG
Russia	Tambov, RU	ASI|RU|RS076|TAMBOV
Russia	Tolyatti, RU	ASI|RU|RS068|TOLYATTI
Russia	Tomsk, RU	ASI|RU|RS079|TOMSK
Russia	Tula, RU	ASI|RU|RS080|TULA
Russia	Tver, RU	ASI|RU|RS082|TVER
Russia	Tyumen, RU	ASI|RU|RS083|TYUMEN
Russia	Tyumen, RU	ASI|RU|RS083|TYUMEN
Russia	Ufa, RU	ASI|RU|RS007|UFA
Russia	Ulan-Ude, RU	ASI|RU|RS086|ULAN-UDE
Russia	Ulyanovsk, RU	ASI|RU|RS085|ULYANOVSK
Russia	Velikiy Novgorod, RU	ASI|RU|RS056|VELIKIY NOVGOROD
Russia	Vladikavkaz, RU	ASI|RU|RS070|VLADIKAVKAZ
Russia	Vladimir, RU	ASI|RU|RS087|VLADIMIR
Russia	Vladivostok, RU	ASI|RU|RS063|VLADIVOSTOK
Russia	Volgodonsk, RU	ASI|RU|RS065|VOLGODONSK
Russia	Volgograd, RU	ASI|RU|RS088|VOLGOGRAD
Russia	Vologda, RU	ASI|RU|RS089|VOLOGDA
Russia	Volzhskiy, RU	ASI|RU|RS088|VOLZHSKIY
Russia	Voronezh, RU	ASI|RU|RS090|VORONEZH
Russia	Votkinsk, RU	ASI|RU|RS084|VOTKINSK
Russia	Yakutsk, RU	ASI|RU|RS091|YAKUTSK
Russia	Yaroslavl, RU	ASI|RU|RS093|YAROSLAVL
Russia	Yoshkar-Ola, RU	ASI|RU|RS049|YOSHKAR-OLA
Russia	Yuzhno-Sahalinsk, RU	ASI|RU|RS067|YUZHNO-SAHALINSK
Russia	Zelenograd, RU	ASI|RU|RS052|ZELENOGRAD
Russia	Zlatoust, RU	ASI|RU|RS013|ZLATOUST
Rwanda	Kigali, RW	AFR|RW|RW009|KIGALI
Saint Helena	Jamestown, SH	AFR|SH|SH000|JAMESTOWN
Saint Kitts And Nevis	Basseterre, GP	CAC|KN|SC003|BASSETERRE
Saint Lucia	Castries, LC	CAC|LC|ST002|CASTRIES

Saint Pierre And Miquelon	Saint-Pierre, PM	NAM|PM|SB000|SAINT-PIERRE
Saint Vincent And The Grenadines	Kingstown, VC	CAC|VC|VC005|KINGSTOWN
Samoa	Apia, WS	OCN|WS|WS000|APIA
San Marino	San Marino, SM	EUR|SM|SM008|SAN MARINO
Sao Tome And Principe	Sao Tome, ST	AFR|ST|TP002|SAO TOME
Saudi Arabia	Al khobar, SA	MEA|SA|SA008|AL KHOBAR
Saudi Arabia	Dammam, SA	MEA|SA|SA008|DAMMAM
Saudi Arabia	Jeddah, SA	MEA|SA|SA011|JEDDAH
Saudi Arabia	Makkah, SA	MEA|SA|SA011|MAKKAH
Saudi Arabia	Medina, SA	MEA|SA|SA005|MEDINA
Saudi Arabia	Riyadh, SA	MEA|SA|SA007|RIYADH
Saudi Arabia	Ta'if, SA	MEA|SA|SA011|TA'IF
Senegal	Dakar, SN	AFR|SN|SG001|DAKAR
Senegal	Kaolack, SN	AFR|SN|SG004|KAOLACK
Senegal	Mbour, SN	AFR|SN|SG009|MBOUR
Senegal	Saint Louis, SN	AFR|SN|SG000|SAINT LOUIS
Senegal	Thies, SN	AFR|SN|SG009|THIÈS
Senegal	Ziguinchor, SN	AFR|SN|SG010|ZIGUINCHOR
Serbia	Beograd, CS	EUR|CS|YI003|BEOGRAD
Serbia	Cacak, CS	EUR|CS|YI003|CACAK
Serbia	Kragujevac, CS	EUR|CS|YI003|KRAGUJEVAC
Serbia	Kraljevo, CS	EUR|CS|YI003|KRALJEVO
Serbia	Krusevac, CS	EUR|CS|YI003|KRUSEVAC
Serbia	Leskovac, CS	EUR|CS|YI003|LESKOVAC
Serbia	Nis, CS	EUR|CS|YI003|NIS
Serbia	Novi Sad, CS	EUR|CS|YI003|NOVI SAD
Serbia	Pancevo, CS	EUR|CS|YI003|PANCEVO
Serbia	Smederevo, CS	EUR|CS|YI003|SMEDEREVO
Serbia	Subotica, CS	EUR|CS|YI003|SUBOTICA
Serbia	Zrenjanin, CS	EUR|CS|YI003|ZRENJANIN
Seychelles	Victoria, SC	AFR|SC|SE000|VICTORIA
Sierra Leone	Freetown, SL	AFR|SL|SL004|FREETOWN
Singapore	Singapore, SG	ASI|SG|SN---|SINGAPORE
Slovakia	Bratislava, SK	EUR|SK|LO002|BRATISLAVA
Slovakia	Kosice, SK	EUR|SK|LO003|KOSICE
Slovenia	Ljubljana, SI	EUR|SI|SI000|LJUBLJANA
Solomon Islands	Honiara, SB	OCN|SB|BP000|HONIARA
Somalia	Mogadishu, SO	AFR|SO|SO002|MOGADISHU
South Africa	Alexander Bay, ZA	AFR|ZA|SF008|ALEXANDER BAY

South Africa	Alexandra, ZA	AFR|ZA|SF004|ALEXANDRA
South Africa	Aliwal North, ZA	AFR|ZA|SF002|ALIWAL NORTH
South Africa	Alldays, ZA	AFR|ZA|SF009|ALLDAYS
South Africa	Amanzimtoti, ZA	AFR|ZA|SF005|AMANZIMTOTI
South Africa	Badplaas, ZA	AFR|ZA|SF006|BADPLAAS
South Africa	Barberton, ZA	AFR|ZA|SF006|BARBERTON
South Africa	Barkly West, ZA	AFR|ZA|SF008|BARKLY WEST
South Africa	Barrydale, ZA	AFR|ZA|SF011|BARRYDALE
South Africa	Beaufort West, ZA	AFR|ZA|SF011|BEAUFORT WEST
South Africa	Bela-Bela, ZA	AFR|ZA|SF005|BELA-BELA
South Africa	Belfast, ZA	AFR|ZA|SF006|BELFAST
South Africa	Benoni, ZA	AFR|ZA|SF004|BENONI
South Africa	Bethlehem, ZA	AFR|ZA|SF003|BETHLEHEM
South Africa	Bhisho, ZA	AFR|ZA|SF002|BHISHO
South Africa	Bloemfontein, ZA	AFR|ZA|SF003|BLOEMFONTEIN
South Africa	Boksburg, ZA	AFR|ZA|SF004|BOKSBURG
South Africa	Botshabelo, ZA	AFR|ZA|SF007|BOTSHABELO
South Africa	Brits, ZA	AFR|ZA|SF007|BRITS
South Africa	Burgersdorp, ZA	AFR|ZA|SF002|BURGERSDORP
South Africa	Caledon, ZA	AFR|ZA|SF011|CALEDON
South Africa	Calvinia, ZA	AFR|ZA|SF008|CALVINIA
South Africa	Cape Point, ZA	AFR|ZA|SF011|CAPE POINT
South Africa	Cape Town , ZA	AFR|ZA|SF011|CAPE TOWN
South Africa	Carnarvon, ZA	AFR|ZA|SF008|CARNARVON
South Africa	Ceres, ZA	AFR|ZA|SF011|CERES
South Africa	Chrissiesmeer, ZA	AFR|ZA|SF006|CHRISSIESMEER
South Africa	Clanwilliam, ZA	AFR|ZA|SF011|CLANWILLIAM
South Africa	Clarens, ZA	AFR|ZA|SF003|CLARENS
South Africa	Coffee Bay, ZA	AFR|ZA|SF002|COFFEE BAY
South Africa	Colesberg, ZA	AFR|ZA|SF008|COLESBERG
South Africa	Cradock, ZA	AFR|ZA|SF002|CRADOCK
South Africa	Danielskuil, ZA	AFR|ZA|SF008|DANIELSKUIL
South Africa	De Aar, ZA	AFR|ZA|SF008|DE AAR
South Africa	Dewetsdorp, ZA	AFR|ZA|SF003|DEWETSDORP
South Africa	Dundee, ZA	AFR|ZA|SF005|DUNDEE
South Africa	Durban, ZA	AFR|ZA|SF005|DURBAN
South Africa	East London, ZA	AFR|ZA|SF002|EAST LONDON
South Africa	Edenburg, ZA	AFR|ZA|SF003|EDENBURG
South Africa	Ellisras, ZA	AFR|ZA|SF009|ELLISRAS
South Africa	Empangeni, ZA	AFR|ZA|SF005|EMPANGENI
South Africa	Ermelo, ZA	AFR|ZA|SF006|ERMELO
South Africa	Eshowe, ZA	AFR|ZA|SF005|ESHOWE
South Africa	Excelsior, ZA	AFR|ZA|SF003|EXCELSIOR

South Africa	Fauresmith, ZA	AFR|ZA|SF003|FAURESMITH
South Africa	Ficksburg, ZA	AFR|ZA|SF003|FICKSBURG
South Africa	Fort Beaufort, ZA	AFR|ZA|SF002|FORT BEAUFORT
South Africa	Franschhoek, ZA	AFR|ZA|SF011|FRANSCHHOEK
South Africa	Fraserburg, ZA	AFR|ZA|SF008|FRASERBURG
South Africa	Gansbaai, ZA	AFR|ZA|SF011|GANSBAAI
South Africa	George, ZA	AFR|ZA|SF011|GEORGE
South Africa	Germiston, ZA	AFR|ZA|SF004|GERMISTON
South Africa	Giants Castle, ZA	AFR|ZA|SF005|GIANTS CASTLE
South Africa	Gordons Bay, ZA	AFR|ZA|SF011|GORDONS BAY
South Africa	Graaff Reinet, ZA	AFR|ZA|SF002|GRAAFF REINET
South Africa	Grabouw, ZA	AFR|ZA|SF011|GRABOUW
South Africa	Grahamstown, ZA	AFR|ZA|SF002|GRAHAMSTOWN
South Africa	Graskop, ZA	AFR|ZA|SF006|GRASKOP
South Africa	Griekwastad, ZA	AFR|ZA|SF008|GRIEKWASTAD
South Africa	Groblersdal, ZA	AFR|ZA|SF006|GROBLERSDAL
South Africa	Haenertsburg, ZA	AFR|ZA|SF009|HAENERTSBURG
South Africa	Harrismith, ZA	AFR|ZA|SF003|HARRISMITH
South Africa	Hartbeespoort, ZA	AFR|ZA|SF007|HARTBEESPOORT
South Africa	Hartenbos, ZA	AFR|ZA|SF011|HARTENBOS
South Africa	Hazyview, ZA	AFR|ZA|SF006|HAZYVIEW
South Africa	Heidelberg, ZA	AFR|ZA|SF004|HEIDELBERG
South Africa	Hermanus, ZA	AFR|ZA|SF011|HERMANUS
South Africa	Hibberdene, ZA	AFR|ZA|SF005|HIBBERDENE
South Africa	Hluhluwe, ZA	AFR|ZA|SF005|HLUHLUWE
South Africa	Hoedspruit, ZA	AFR|ZA|SF009|HOEDSPRUIT
South Africa	Hogsback, ZA	AFR|ZA|SF002|HOGSBACK
South Africa	Hondeklip Bay, ZA	AFR|ZA|SF008|HONDEKLIP BAY
South Africa	Howick, ZA	AFR|ZA|SF005|HOWICK
South Africa	Ixopo, ZA	AFR|ZA|SF005|IXOPO
South Africa	Jacobsdal, ZA	AFR|ZA|SF003|JACOBSDAL
South Africa	Johannesburg, ZA	AFR|ZA|SF004|JOHANNESBURG
South Africa	Joubertina, ZA	AFR|ZA|SF002|JOUBERTINA
South Africa	Kakamas, ZA	AFR|ZA|SF008|KAKAMAS
South Africa	Kamieskroon, ZA	AFR|ZA|SF008|KAMIESKROON
South Africa	Kempton Park, ZA	AFR|ZA|SF004|KEMPTON PARK
South Africa	Kimberley, ZA	AFR|ZA|SF008|KIMBERLEY
South Africa	King Williams Town, ZA	AFR|ZA|SF002|KING WILLIAMS TOWN
South Africa	Klerksdorp, ZA	AFR|ZA|SF007|KLERKSDORP
South Africa	Knysna, ZA	AFR|ZA|SF011|KNYSNA
South Africa	Kokstad, ZA	AFR|ZA|SF005|KOKSTAD
South Africa	Komatipoort, ZA	AFR|ZA|SF006|KOMATIPOORT
South Africa	Kroonstad, ZA	AFR|ZA|SF003|KROONSTAD

South Africa	Krugersdorp, ZA	AFR|ZA|SF004|KRUGERSDORP
South Africa	Kuruman, ZA	AFR|ZA|SF008|KURUMAN
South Africa	Ladysmith, ZA	AFR|ZA|SF005|LADYSMITH
South Africa	Langebaan, ZA	AFR|ZA|SF011|LANGEBAAN
South Africa	Lephalale, ZA	AFR|ZA|SF009|LEPHALALE
South Africa	Levubu, ZA	AFR|ZA|SF009|LEVUBU
South Africa	Lichtenburg, ZA	AFR|ZA|SF007|LICHTENBURG
South Africa	Loeriesfontein, ZA	AFR|ZA|SF008|LOERIESFONTEIN
South Africa	Lydenburg, ZA	AFR|ZA|SF006|LYDENBURG
South Africa	Mafikeng, ZA	AFR|ZA|SF007|MAFIKENG
South Africa	Magaliesburg, ZA	AFR|ZA|SF004|MAGALIESBURG
South Africa	Malmesbury, ZA	AFR|ZA|SF011|MALMESBURY
South Africa	Margate, ZA	AFR|ZA|SF005|MARGATE
South Africa	Mazeppa Bay, ZA	AFR|ZA|SF002|MAZEPPA BAY
South Africa	Messina, ZA	AFR|ZA|SF009|MESSINA
South Africa	Middelburg, ZA	AFR|ZA|SF006|MIDDELBURG
South Africa	Midrand, ZA	AFR|ZA|SF004|MIDRAND
South Africa	Mmabatho, ZA	AFR|ZA|SF007|MMABATHO
South Africa	Mokopane, ZA	AFR|ZA|SF009|MOKOPANE
South Africa	Mooi River, ZA	AFR|ZA|SF005|MOOI RIVER
South Africa	Mossel Bay, ZA	AFR|ZA|SF011|MOSSEL BAY
South Africa	Mthatha, ZA	AFR|ZA|SF002|MTHATHA
South Africa	Musina, ZA	AFR|ZA|SF009|MUSINA
South Africa	Nelspruit, ZA	AFR|ZA|SF006|NELSPRUIT
South Africa	Newcastle, ZA	AFR|ZA|SF005|NEWCASTLE
South Africa	Ngqura, ZA	AFR|ZA|SF002|NGQURA
South Africa	Nieu Bethesda, ZA	AFR|ZA|SF002|NIEU BETHESDA
South Africa	Nieuwoudtville, ZA	AFR|ZA|SF008|NIEUWOUDTVILLE
South Africa	Nylstroom, ZA	AFR|ZA|SF009|NYLSTROOM
South Africa	Ohrigstad, ZA	AFR|ZA|SF006|OHRIGSTAD
South Africa	Oudtshoorn, ZA	AFR|ZA|SF011|OUDTSHOORN
South Africa	Paarl, ZA	AFR|ZA|SF011|PAARL
South Africa	Petrusburg, ZA	AFR|ZA|SF003|PETRUSBURG
South Africa	Phalaborwa, ZA	AFR|ZA|SF009|PHALABORWA
South Africa	Philippolis, ZA	AFR|ZA|SF003|PHILIPPOLIS
South Africa	Piet Retief, ZA	AFR|ZA|SF006|PIET RETIEF
South Africa	Pietermaritzburg, ZA	AFR|ZA|SF005|PIETERMARITZBURG
South Africa	Pietersburg, ZA	AFR|ZA|SF009|PIETERSBURG
South Africa	Pilgrims Rest, ZA	AFR|ZA|SF006|PILGRIMS REST
South Africa	Plettenberg Bay, ZA	AFR|ZA|SF011|PLETTENBERG BAY
South Africa	Polokwane, ZA	AFR|ZA|SF009|POLOKWANE
South Africa	Port Alfred, ZA	AFR|ZA|SF002|PORT ALFRED
South Africa	Port Elizabeth, ZA	AFR|ZA|SF002|PORT ELIZABETH

South Africa	Port Shepstone, ZA	AFR|ZA|SF005|PORT SHEPSTONE
South Africa	Port St. Johns, ZA	AFR|ZA|SF002|PORT ST. JOHNS
South Africa	Postmasburg, ZA	AFR|ZA|SF008|POSTMASBURG
South Africa	Potchefstroom, ZA	AFR|ZA|SF007|POTCHEFSTROOM
South Africa	Potgietersrus, ZA	AFR|ZA|SF009|POTGIETERSRUS
South Africa	Pretoria, ZA	AFR|ZA|SF004|PRETORIA
South Africa	Prieska, ZA	AFR|ZA|SF008|PRIESKA
South Africa	Queenstown, ZA	AFR|ZA|SF002|QUEENSTOWN
South Africa	Richards Bay, ZA	AFR|ZA|SF005|RICHARDS BAY
South Africa	Riversdale, ZA	AFR|ZA|SF011|RIVERSDALE
South Africa	Robertson, ZA	AFR|ZA|SF011|ROBERTSON
South Africa	Roodepoort, ZA	AFR|ZA|SF004|ROODEPOORT
South Africa	Rustenburg, ZA	AFR|ZA|SF007|RUSTENBURG
South Africa	Sabie, ZA	AFR|ZA|SF006|SABIE
South Africa	Saint Francis, ZA	AFR|ZA|SF002|SAINT FRANCIS
South Africa	Saint Lucia, ZA	AFR|ZA|SF005|SAINT LUCIA
South Africa	Saldanha, ZA	AFR|ZA|SF011|SALDANHA
South Africa	Sandton, ZA	AFR|ZA|SF004|SANDTON
South Africa	Sasolburg, ZA	AFR|ZA|SF003|SASOLBURG
South Africa	Sedgefield, ZA	AFR|ZA|SF011|SEDGEFIELD
South Africa	Skukuza, ZA	AFR|ZA|SF006|SKUKUZA
South Africa	Slangkop, ZA	AFR|ZA|SF011|SLANGKOP
South Africa	Smithfield, ZA	AFR|ZA|SF003|SMITHFIELD
South Africa	Somerset East, ZA	AFR|ZA|SF002|SOMERSET EAST
South Africa	Somerset West, ZA	AFR|ZA|SF011|SOMERSET WEST
South Africa	Soweto, ZA	AFR|ZA|SF004|SOWETO
South Africa	Springbok, ZA	AFR|ZA|SF008|SPRINGBOK
South Africa	Springs, ZA	AFR|ZA|SF004|SPRINGS
South Africa	Standerton, ZA	AFR|ZA|SF006|STANDERTON
South Africa	Standerton, ZA	AFR|ZA|SF006|STANDERTON
South Africa	Stellenbosch, ZA	AFR|ZA|SF011|STELLENBOSCH
South Africa	Stillbaai, ZA	AFR|ZA|SF011|STILLBAAI
South Africa	Strand, ZA	AFR|ZA|SF011|STRAND
South Africa	Sutherland, ZA	AFR|ZA|SF005|SUTHERLAND
South Africa	Swellendam, ZA	AFR|ZA|SF011|SWELLENDAM
South Africa	Taung, ZA	AFR|ZA|SF007|TAUNG
South Africa	Tembisa, ZA	AFR|ZA|SF004|TEMBISA
South Africa	Thabazimbi, ZA	AFR|ZA|SF009|THABAZIMBI
South Africa	Thohoyandou, ZA	AFR|ZA|SF009|THOHOYANDOU
South Africa	Tzaneen, ZA	AFR|ZA|SF009|TZANEEN
South Africa	Uitenhage, ZA	AFR|ZA|SF002|UITENHAGE
South Africa	Ulundi, ZA	AFR|ZA|SF005|ULUNDI
South Africa	Umhlanga Rock, ZA	AFR|ZA|SF005|UMHLANGA ROCK

South Africa	Umlazi, ZA	AFR|ZA|SF005|UMLAZI
South Africa	Umtata, ZA	AFR|ZA|SF002|UMTATA
South Africa	Underburg, ZA	AFR|ZA|SF005|UNDERBURG
South Africa	Upington, ZA	AFR|ZA|SF008|UPINGTON
South Africa	Uvongo, ZA	AFR|ZA|SF005|UVONGO
South Africa	Vaalwater, ZA	AFR|ZA|SF009|VAALWATER
South Africa	Vanderbijlpark, ZA	AFR|ZA|SF004|VANDERBIJLPARK
South Africa	Vereeniging, ZA	AFR|ZA|SF004|VEREENIGING
South Africa	Virginia, ZA	AFR|ZA|SF003|VIRGINIA
South Africa	Volksrust, ZA	AFR|ZA|SF006|VOLKSRUST
South Africa	Vredendal, ZA	AFR|ZA|SF011|VREDENDAL
South Africa	Vryburg, ZA	AFR|ZA|SF007|VRYBURG
South Africa	Vryheid, ZA	AFR|ZA|SF005|VRYHEID
South Africa	Welkom, ZA	AFR|ZA|SF003|WELKOM
South Africa	Wellington, ZA	AFR|ZA|SF011|WELLINGTON
South Africa	Wepener, ZA	AFR|ZA|SF003|WEPENER
South Africa	White River, ZA	AFR|ZA|SF006|WHITE RIVER
South Africa	Wilderness, ZA	AFR|ZA|SF011|WILDERNESS
South Africa	Winburg, ZA	AFR|ZA|SF003|WINBURG
South Africa	Witbank, ZA	AFR|ZA|SF006|WITBANK
South Africa	Worcester, ZA	AFR|ZA|SF011|WORCESTER
South Africa	Zastron, ZA	AFR|ZA|SF003|ZASTRON
South Korea	Andong, KR	ASI|KR|KS010|ANDONG
South Korea	Ansan, KR	ASI|KR|KS009|ANSAN
South Korea	Cheju, KR	ASI|KR|KS003|CHEJU
South Korea	Cheongju, KR	ASI|KR|KS001|CHEONGJU
South Korea	Chuncheon, KR	ASI|KR|KS007|CHUNCHEON
South Korea	Chungju, KR	ASI|KR|KS001|CHUNGJU
South Korea	Hanam, KR	ASI|KR|KS009|HANAM
South Korea	Iri, KR	ASI|KR|KS004|IRI
South Korea	Kangnung, KR	ASI|KR|KS007|KANGNUNG
South Korea	Kimhae, KR	ASI|KR|KS011|KIMHAE
South Korea	Kunsan, KR	ASI|KR|KS004|KUNSAN
South Korea	Kwangchu, KR	ASI|KR|KS008|KWANGCHU
South Korea	Kyong Ju, KR	ASI|KR|KS010|KYONG JU
South Korea	Masan, KR	ASI|KR|KS011|MASAN
South Korea	Onyang, KR	ASI|KR|KS002|ONYANG
South Korea	Pohang, KR	ASI|KR|KS010|POHANG
South Korea	Pusan, KR	ASI|KR|KS012|PUSAN
South Korea	Seoul, KR	ASI|KR|KS013|SEOUL
South Korea	Suwon, KR	ASI|KR|KS002|SUWON
South Korea	Taebaek, KR	ASI|KR|KS007|TAEBAEK
South Korea	Taegu, KR	ASI|KR|KS002|TAEGU

South Korea	Uijeongbu, KR	ASI|KR|KS009|UIJEONGBU
South Korea	Ulsan, KR	ASI|KR|KS016|ULSAN
South Korea	Wonju, KR	ASI|KR|KS007|WONJU
South Korea	Yosu, KR	ASI|KR|KS005|YOSU
Spain	Acala De Henares, ES	EUR|ES|SP013|ALCALÁ DE HENARES
Spain	Albacete, ES	EUR|ES|SP006|ALBACETE
Spain	Alcobendas, ES	EUR|ES|SP013|ALCOBENDAS
Spain	Alcorcon, ES	EUR|ES|SP013|ALCORCÓN
Spain	Algeciras, ES	EUR|ES|SP001|ALGECIRAS
Spain	Alicante, ES	EUR|ES|SP016|ALICANTE
Spain	Almeria, ES	EUR|ES|SP001|ALMERÍA
Spain	Badajoz, ES	EUR|ES|SP010|BADAJOZ
Spain	Badalona, ES	EUR|ES|SP008|BADALONA
Spain	Baracaldo, ES	EUR|ES|SP017|BARACALDO
Spain	Barcelona, ES	EUR|ES|SP008|BARCELONA
Spain	Bilbao, ES	EUR|ES|SP017|BILBAO
Spain	Burgos, ES	EUR|ES|SP007|BURGOS
Spain	Cadiz, ES	EUR|ES|SP001|CÁDIZ
Spain	Cartagena, ES	EUR|ES|SP014|CARTAGENA
Spain	Castellon, ES	EUR|ES|SP016|CASTELLÓN DE LA PLANA
Spain	Cordoba, ES	EUR|ES|SP001|CÓRDOBA
Spain	Elche, ES	EUR|ES|SP016|ELCHE
Spain	Fuenlabrada, ES	EUR|ES|SP013|FUENLABRADA
Spain	Getafe, ES	EUR|ES|SP013|GETAFE
Spain	Gijon, ES	EUR|ES|SP003|GIJÓN
Spain	Granada, ES	EUR|ES|SP001|GRANADA
Spain	Huelva, ES	EUR|ES|SP001|HUELVA
Spain	Jaen, ES	EUR|ES|SP001|JAÉN
Spain	Jerez, ES	EUR|ES|SP001|JÉREZ DE LA FRONTERA
Spain	La Laguna, ES	EUR|ES|SP018|LA LAGUNA
Spain	Las Palmas De Gran Canaria, ES	EUR|ES|SP018|LAS PALMAS DE GRAN CANARIA
Spain	Leganes, ES	EUR|ES|SP013|LEGANÉS
Spain	Leon, ES	EUR|ES|SP007|LEÓN
Spain	Lleida, ES	EUR|ES|SP008|LLEIDA
Spain	Logrono, ES	EUR|ES|SP012|LOGROÑO
Spain	Madrid, ES	EUR|ES|SP013|MADRID
Spain	Malaga, ES	EUR|ES|SP001|MÁLAGA
Spain	Mataro, ES	EUR|ES|SP008|MATARÓ
Spain	Mostoles, ES	EUR|ES|SP013|MÓSTOLES
Spain	Murcia, ES	EUR|ES|SP014|MURCIA
Spain	Ourense, ES	EUR|ES|SP011|OURENSE
Spain	Oviedo, ES	EUR|ES|SP003|OVIEDO

Spain	Palma De Mallorca, ES	EUR|ES|SP004|PALMA DE MALLORCA
Spain	Pamplona, ES	EUR|ES|SP015|PAMPLONA
Spain	Sabadell, ES	EUR|ES|SP008|SABADELL
Spain	Salamanca, ES	EUR|ES|SP007|SALAMANCA
Spain	San Sebastian, ES	EUR|ES|SP011|SAN SEBASTIÁN
Spain	Santa Coloma De Gramanet, ES	EUR|ES|SP008|SANTA COLOMA DE GRAMANET
Spain	Santa Cruz De Tenerife, ES	EUR|ES|SP018|SANTA CRUZ DE TENERIFE
Spain	Santander, ES	EUR|ES|SP005|SANTANDER
Spain	Sevilla, ES	EUR|ES|SP001|SEVILLA
Spain	Tarragona, ES	EUR|ES|SP008|TARRAGONA
Spain	Tarrasa, ES	EUR|ES|SP008|TARRASA
Spain	The Groyne, ES	EUR|ES|SP011|LA CORUÑA
Spain	Valencia, ES	EUR|ES|SP016|VALENCIA
Spain	Valladolid, ES	EUR|ES|SP007|VALLADOLID
Spain	Vigo, ES	EUR|ES|SP011|VIGO
Spain	Zaragoza, ES	EUR|ES|SP002|ZARAGOZA
Sri Lanka	Colombo, LK	ASI|LK|CE009|COLOMBO
Sri Lanka	Dehiwala, LK	ASI|LK|CE009|DEHIWALA-MOUNT LAVINIA
Sri Lanka	Jaffna, LK	ASI|LK|CE010|JAFFNA
Sri Lanka	Kandy, LK	ASI|LK|CE001|KANDY
Sri Lanka	Moratuwa, LK	ASI|LK|CE009|MORATUWA
Sudan	Juba, SD	AFR|SD|SU027|JUBA
Sudan	Kassala, SD	AFR|SD|SU029|KASSALA
Sudan	Khartoum, SD	AFR|SD|SU005|KHARTOUM
Sudan	Khartoum North, SD	AFR|SD|SU005|KHARTOUM NORTH
Sudan	Kosti, SD	AFR|SD|SU028|KOSTI
Sudan	Nyala, SD	AFR|SD|SU016|NYALA
Sudan	Omdurman, SD	AFR|SD|SU005|OMDURMAN
Sudan	Port Sudan, SD	AFR|SD|SU029|PORT SUDAN
Suriname	Paramaribo, SR	SAM|SR|NS007|PARAMARIBO
Swaziland	Mbabane, SZ	AFR|SZ|WZ000|MBABANE
Sweden	Aare, SE	EUR|SE|SW006|AARE
Sweden	Boraas, SE	EUR|SE|SW021|BORAAS
Sweden	Gaevle, SE	EUR|SE|SW003|GAEVLE
Sweden	Gothenburg, SE	EUR|SE|SW021|GOTHENBURG
Sweden	Helsingborg, SE	EUR|SE|SW013|HELSINGBORG
Sweden	Idre, SE	EUR|SE|SW002|IDRE
Sweden	Joenkoeping, SE	EUR|SE|SW007|JOENKOEPING
Sweden	Kalmar, SE	EUR|SE|SW008|KALMAR
Sweden	Karlskrona, SE	EUR|SE|SW001|KARLSKRONA
Sweden	Karlstad, SE	EUR|SE|SW017|KARLSTAD

Sweden	Kiruna, SE	EUR|SE|SW010|KIRUNA
Sweden	Kristianstad, SE	EUR|SE|SW013|KRISTIANSTAD
Sweden	Linkoeping, SE	EUR|SE|SW012|LINKOEPING
Sweden	Luleaa, SE	EUR|SE|SW010|LULEAA
Sweden	Lund, SE	EUR|SE|SW013|LUND
Sweden	Malmoe, SE	EUR|SE|SW013|MALMOE
Sweden	Norrkoeping, SE	EUR|SE|SW012|NORRKOEPING
Sweden	Oestersund, SE	EUR|SE|SW006|OESTERSUND
Sweden	Orebro, SE	EUR|SE|SW011|OREBRO
Sweden	Saelen, SE	EUR|SE|SW002|SAELEN
Sweden	Skoevde, SE	EUR|SE|SW021|SKOEVDE
Sweden	Stockholm, SE	EUR|SE|SW015|STOCKHOLM
Sweden	Sundsvall, SE	EUR|SE|SW019|SUNDSVALL
Sweden	Trelleborg, SE	EUR|SE|SW013|TRELLEBORG
Sweden	Trollhaettan, SE	EUR|SE|SW021|TROLLHAETTAN
Sweden	Uddevalla, SE	EUR|SE|SW021|UDDEVALLA
Sweden	Umeaa, SE	EUR|SE|SW018|UMEAA
Sweden	Uppsala, SE	EUR|SE|SW016|UPPSALA
Sweden	Vaesteraas, SE	EUR|SE|SW020|VAESTERAAS
Sweden	Visby, SE	EUR|SE|SW004|VISBY
Sweden	Ystad, SE	EUR|SE|SW013|YSTAD
Switzerland	Bale, CH	EUR|CH|SZ005|BÂLE
Switzerland	Berne, CH	EUR|CH|SZ006|BERNE
Switzerland	Geneve, CH	EUR|CH|SZ008|GENÈVE
Switzerland	Lausanne, CH	EUR|CH|SZ024|LAUSANNE
Switzerland	Luzern, CH	EUR|CH|SZ012|LUZERN
Switzerland	Winterthur, CH	EUR|CH|SZ026|WINTERTHUR
Switzerland	Zurich, CH	EUR|CH|SZ026|ZÜRICH
Syria	Aleppo, SY	MEA|SY|SY009|ALEPPO
Syria	Al-Hasakeh, SY	MEA|SY|SY001|AL-HASAKEH
Syria	Al-Rakka, SY	MEA|SY|SY004|AL-RAKKA
Syria	Damascus, SY	MEA|SY|SY008|DAMASCUS
Syria	Hama, SY	MEA|SY|SY010|HAMA
Syria	Homs, SY	MEA|SY|SY011|HOMS
Syria	Lattakia, SY	MEA|SY|SY002|LATTAKIA
Taiwan	Hsinchu, TW	ASI|TW|TW018|HSINCHU
Taiwan	Hualien, TW	ASI|TW|TW018|HUALIEN
Taiwan	Kao-Hsiung, TW	ASI|TW|TW006|KAO-HSIUNG
Taiwan	Keelung, TW	ASI|TW|TW018|KEELUNG
Taiwan	Taichung, TW	ASI|TW|TW018|TAICHUNG
Taiwan	Tainan, TW	ASI|TW|TW018|TAINAN
Taiwan	Taipei, TW	ASI|TW|TW018|TAIPEI
Taiwan	Taitung, TW	ASI|TW|TW018|TAITUNG

Tajikistan	Dushanbe, TJ	ASI|TJ|TI000|DUSHANBE
Tanzania	Arusha, TZ	AFR|TZ|TZ000|ARUSHA
Tanzania	Dar Es Salaam, TZ	AFR|TZ|TZ000|DAR ES SALAAM
Tanzania	Dodoma, TZ	AFR|TZ|TZ000|DODOMA
Tanzania	Mbeya, TZ	AFR|TZ|TZ000|MBEYA
Tanzania	Morogoro, TZ	AFR|TZ|TZ000|MOROGORO
Tanzania	Mwanza, TZ	AFR|TZ|TZ000|MWANZA
Tanzania	Shinyanga, TZ	AFR|TZ|TZ000|SHINYANGA
Tanzania	Tanga, TZ	AFR|TZ|TZ000|TANGA
Tanzania	Zanzibar, TZ	AFR|TZ|TZ000|ZANZIBAR
Thailand	Bangkok, TH	ASI|TH|TH017|BANGKOK
Thailand	Chiang Mai, TH	ASI|TH|TH008|CHIANG MAI
Thailand	Chon Buri, TH	ASI|TH|TH010|CHON BURI
Thailand	Kanchanaburi, TH	ASI|TH|TH014|KANCHANABURI
Thailand	Khon Kaen, TH	ASI|TH|TH015|KHON KAEN
Thailand	Nakhon Pathom, TH	ASI|TH|TH026|NAKHON PATHOM
Thailand	Nakhon Ratchasima, TH	ASI|TH|TH028|NAKHON RATCHASIMA
Thailand	Nakhon Sawan, TH	ASI|TH|TH029|NAKHON SAWAN
Thailand	Nakhon Si Thammarat, TH	ASI|TH|TH030|NAKHON SI THAMMARAT
Thailand	Pathum Thani, TH	ASI|TH|TH036|PATHUM THANI
Thailand	Pattaya, TH	ASI|TH|TH010|PATTAYA
Thailand	Phuket, TH	ASI|TH|TH047|PHUKET
Thailand	Rayong, TH	ASI|TH|TH052|RAYONG
Thailand	Samut Prakan, TH	ASI|TH|TH056|SAMUT PRAKAN
Thailand	Samut Sakhon, TH	ASI|TH|TH057|SAMUT SAKHON
Thailand	Saraburi, TH	ASI|TH|TH059|SARABURI
Thailand	Songkhla, TH	ASI|TH|TH063|SONGKHLA
Thailand	Sukhothai, TH	ASI|TH|TH064|SUKHOTHAI
Thailand	Surat Thani, TH	ASI|TH|TH066|SURAT THANI
Thailand	Ubon Ratchathani, TH	ASI|TH|TH071|UBON RATCHATHANI
Thailand	Udon Thani, TH	ASI|TH|TH072|UDON THANI
The Bahamas	Nassau, BS	CAC|BS|BF016|NASSAU
The Gambia	Banjul, GM	AFR|GM|GA001|BANJUL
Togo	Lome, TG	AFR|TG|TO000|LOME
Tonga	Nuku'Alofa, TO	OCN|TO|TO002|NUKU'ALOFA
Trinidad And Tobago	Port-of-Spain, TT	CAC|TT|TD005|PORT-OF-SPAIN
Tunisia	Bizerte, TN	AFR|TN|TS008|BIZERTE
Tunisia	Gabes, TN	AFR|TN|TS013|GABES
Tunisia	Kairouan, TN	AFR|TN|TS005|KAIROUAN
Tunisia	Sfax, TN	AFR|TN|TS015|SFAX
Tunisia	Tunis, TN	AFR|TN|TS000|TUNIS
Turkey	Adana, TR	MEA|TR|TU001|ADANA

Turkey	Adiyaman, TR	MEA|TR|TU002|ADIYAMAN
Turkey	Afyon, TR	MEA|TR|TU003|AFYON
Turkey	Aksaray, TR	MEA|TR|TU042|AKSARAY
Turkey	Ankara, TR	MEA|TR|TU007|ANKARA
Turkey	Antalya, TR	MEA|TR|TU008|ANTALYA
Turkey	Aydin, TR	MEA|TR|TU011|AYDIN
Turkey	Balikesir, TR	MEA|TR|TU012|BALIKESIR
Turkey	Batman, TR	MEA|TR|TU000|BATMAN
Turkey	Bursa, TR	MEA|TR|TU021|BURSA
Turkey	Corum, TR	MEA|TR|TU024|CORUM
Turkey	Cotyaeum, TR	MEA|TR|TU054|KÜTAHYA
Turkey	Denizli, TR	MEA|TR|TU025|DENIZLI
Turkey	Diyarbakir, TR	MEA|TR|TU026|DIYARBAKIR
Turkey	Edirne, TR	MEA|TR|TU027|EDIRNE
Turkey	Elazig, TR	MEA|TR|TU028|ELAZIG
Turkey	Erzurum, TR	MEA|TR|TU030|ERZURUM
Turkey	Eskisehir, TR	MEA|TR|TU031|ESKISEHIR
Turkey	Gaziantep, TR	MEA|TR|TU032|GAZIANTEP
Turkey	Gebze, TR	MEA|TR|TU052|GEBZE
Turkey	Hatay, TR	MEA|TR|TU036|HATAY
Turkey	Icel, TR	MEA|TR|TU037|IÇEL
Turkey	Iskenderun, TR	MEA|TR|TU036|ISKENDERUN
Turkey	Isparta, TR	MEA|TR|TU039|ISPARTA
Turkey	Istanbul, TR	MEA|TR|TU040|ISTANBUL
Turkey	Izmir, TR	MEA|TR|TU041|IZMIR
Turkey	Kahramanmaras, TR	MEA|TR|TU042|KAHRAMANMARAS
Turkey	Karabuk, TR	MEA|TR|TU000|KARABUK
Turkey	Karaman, TR	MEA|TR|TU044|KARAMAN
Turkey	Kayseri, TR	MEA|TR|TU047|KAYSERI
Turkey	Kirikkale, TR	MEA|TR|TU000|KIRIKKALE
Turkey	Kocaeli, TR	MEA|TR|TU052|KOCAELI
Turkey	Konya, TR	MEA|TR|TU053|KONYA
Turkey	Malatya, TR	MEA|TR|TU055|MALATYA
Turkey	Manisa, TR	MEA|TR|TU056|MANISA
Turkey	Mardin, TR	MEA|TR|TU047|MARDIN
Turkey	Ordu, TR	MEA|TR|TU062|ORDU
Turkey	Osmaniye, TR	MEA|TR|TU000|OSMANIYE
Turkey	Sakarya, TR	MEA|TR|TU065|SAKARYA
Turkey	Samsun, TR	MEA|TR|TU066|SAMSUN
Turkey	Siirt, TR	MEA|TR|TU000|SIIRT
Turkey	Sivas, TR	MEA|TR|TU071|SIVAS
Turkey	Tarsus, TR	MEA|TR|TU037|TARSUS
Turkey	Tekirdag, TR	MEA|TR|TU072|TEKIRDAG

Turkey	Trabzon, TR	MEA|TR|TU074|TRABZON
Turkey	Urfa, TR	MEA|TR|TU067|URFA
Turkey	Usak, TR	MEA|TR|TU076|USAK
Turkey	Van, TR	MEA|TR|TU077|VAN
Turkey	Zonguldak, TR	MEA|TR|TU000|ZONGULDAK
Turkmenistan	Ashkhabad, TM	ASI|TM|TX001|ASHKHABAD
Turkmenistan	Chardzhou, TM	ASI|TM|TX004|CHARDZHOU
Turkmenistan	Tashauz, TM	ASI|TM|TX003|TASHAUZ
Turks And Caicos Islands	Grand Turk, TC	CAC|TC|TK---|GRAND TURK
Uganda	Arua, UG	AFR|UG|UG000|ARUA
Uganda	Entebbe, UG	AFR|UG|UG000|ENTEBBE
Uganda	Fort Portal, UG	AFR|UG|UG000|FORT PORTAL
Uganda	Gulu, UG	AFR|UG|UG000|GULU
Uganda	Jinja, UG	AFR|UG|UG000|JINJA
Uganda	Kampala, UG	AFR|UG|UG000|KAMPALA
Uganda	Lira, UG	AFR|UG|UG000|LIRA
Uganda	Masaka, UG	AFR|UG|UG000|MASAKA
Uganda	Mbale, UG	AFR|UG|UG000|MBALE
Uganda	Mbarara, UG	AFR|UG|UG000|MBARARA
Uganda	Moroto, UG	AFR|UG|UG000|MOROTO
Uganda	Port Bell, UG	AFR|UG|UG000|PORT BELL
Uganda	Soroti, UG	AFR|UG|UG000|SOROTI
Ukraine	Alchevsk, UA	EUR|UA|UP012|ALCHEVSK
Ukraine	Berdyansk, UA	EUR|UA|UP004|BERDYANSK
Ukraine	Bila Tserkva, UA	EUR|UA|UP009|BELAYA TSERKOV
Ukraine	Cherkassy, UA	EUR|UA|UP024|CHERKASSY
Ukraine	Chernigov, UA	EUR|UA|UP001|CHERNIGOV
Ukraine	Chernovtsy, UA	EUR|UA|UP002|CHERNOVTSY
Ukraine	Dneprodzerzhinsk, UA	EUR|UA|UP003|DNEPRODZERZHINSK
Ukraine	Dnepropetrovsk, UA	EUR|UA|UP003|DNEPROPETROVSK
Ukraine	Donetsk, UA	EUR|UA|UP006|DONETSK
Ukraine	Gorlovka, UA	EUR|UA|UP004|GORLOVKA
Ukraine	Ivano-Frankovsk, UA	EUR|UA|UP005|IVANO-FRANKOVSK
Ukraine	Kertch, UA	EUR|UA|UP011|KERTCH
Ukraine	Kherson, UA	EUR|UA|UP007|KHERSON
Ukraine	Khmelnitsky, UA	EUR|UA|UP008|KHMELNITSKY
Ukraine	Kiev, UA	EUR|UA|UP009|KIEV
Ukraine	Kirovograd, UA	EUR|UA|UP010|KIROVOGRAD
Ukraine	Kramatorsk, UA	EUR|UA|UP004|KRAMATORSK
Ukraine	Lugansk, UA	EUR|UA|UP012|LUGANSK
Ukraine	Lutsk, UA	EUR|UA|UP020|LUTSK
Ukraine	Lvov, UA	EUR|UA|UP013|LVOV

Ukraine	Lysychansk, UA	EUR|UA|UP012|LYSYCHANSK
Ukraine	Makeyevka, UA	EUR|UA|UP004|MAKEYEVKA
Ukraine	Mariupol, UA	EUR|UA|UP004|MARIUPOL
Ukraine	Melitopol, UA	EUR|UA|KZ000|MELITOPOL
Ukraine	Odessa, UA	EUR|UA|UP015|ODESSA
Ukraine	Pavlograd, UA	EUR|UA|UP003|PAVLOGRAD
Ukraine	Poltava, UA	EUR|UA|UP026|POLTAVA
Ukraine	Rovno, UA	EUR|UA|UP016|ROVNO
Ukraine	Sevastopol, UA	EUR|UA|UP011|SEVASTOPOL
Ukraine	Severodonetsk, UA	EUR|UA|UP012|SEVERODONETSK
Ukraine	Simferopol, UA	EUR|UA|UP011|SIMFEROPOL
Ukraine	Slavyansk, UA	EUR|UA|UP004|SLAVYANSK
Ukraine	Stakhanov, UA	EUR|UA|UP012|STAKHANOV
Ukraine	Sumy, UA	EUR|UA|UP017|SUMY
Ukraine	Ternopol, UA	EUR|UA|UP018|TERNOPOL
Ukraine	Uzhgorod, UA	EUR|UA|UP021|UZHGOROD
Ukraine	Zaporozhye, UA	EUR|UA|UP022|ZAPOROZHYE
Ukraine	Zhitomir, UA	EUR|UA|UP023|ZHITOMIR
United Arab Emirates	Abu Dhabi, AE	MEA|AE|AE002|ABU DHABI
United Arab Emirates	Al Ain, AE	MEA|AE|AE002|AL AIN
United Arab Emirates	Al Fujairah, AE	MEA|AE|AE003|AL FUJAIRAH
United Arab Emirates	Dubai, AE	MEA|AE|AE005|DUBAI
United Arab Emirates	Ras Al Khaimah, AE	MEA|AE|AE006|RAS AL KHAIMAH
United Arab Emirates	Sharjah, AE	MEA|AE|AE004|SHARJAH
United Kingdom	Aberdeen, UK	EUR|UK|UK002|ABERDEEN
United Kingdom	Ashfield, UK	EUR|UK|UK001|ASHFIELD
United Kingdom	Banstead, UK	EUR|UK|UK224|BANSTEAD
United Kingdom	Barking and Dagenham, UK	EUR|UK|UK001|BARKING AND DAGENHAM
United Kingdom	Barnet, UK	EUR|UK|UK001|BARNET
United Kingdom	Barnsley, UK	EUR|UK|UK001|BARNSLEY
United Kingdom	Basildon, UK	EUR|UK|UK001|BASILDON
United Kingdom	Baskingstoke and Deane, UK	EUR|UK|UK001|BASKINGSTOKE AND DEANE
United Kingdom	Bath and North East Somerset, UK	EUR|UK|UK001|BATH AND NORTH EAST SOMERSET
United Kingdom	Bedford, UK	EUR|UK|UK001|BEDFORD
United Kingdom	Bedworth, UK	EUR|UK|UK238|BEDWORTH
United Kingdom	Belfast, UK	EUR|UK|UK002|BELFAST

United Kingdom	Bexley, UK	EUR|UK|UK001|BEXLEY
United Kingdom	Birmingham, UK	EUR|UK|UK001|BIRMINGHAM
United Kingdom	Blackburn, UK	EUR|UK|UK001|BLACKBURN
United Kingdom	Blackpool, UK	EUR|UK|UK001|BLACKPOOL
United Kingdom	Bolton, UK	EUR|UK|UK001|BOLTON
United Kingdom	Bournemouth, UK	EUR|UK|UK001|BOURNEMOUTH
United Kingdom	Bradford, UK	EUR|UK|UK001|BRADFORD
United Kingdom	Braintree, UK	EUR|UK|UK001|BRAINTREE
United Kingdom	Brent, UK	EUR|UK|UK001|BRENT
United Kingdom	Bridgend, UK	EUR|UK|UK003|BRIDGEND
United Kingdom	Brighton, UK	EUR|UK|UK001|BRIGHTON
United Kingdom	Bristol, UK	EUR|UK|UK001|BRISTOL
United Kingdom	Bromley, UK	EUR|UK|UK001|BROMLEY
United Kingdom	Bury, UK	EUR|UK|UK001|BURY
United Kingdom	Caerphilly, UK	EUR|UK|UK004|CAERPHILLY
United Kingdom	Calderdale, UK	EUR|UK|UK001|CALDERDALE
United Kingdom	Cambridge, UK	EUR|UK|UK001|CAMBRIDGE
United Kingdom	Camden, UK	EUR|UK|UK001|CAMDEN
United Kingdom	Canterbury, UK	EUR|UK|UK001|CANTERBURY
United Kingdom	Cardiff, UK	EUR|UK|UK004|CARDIFF
United Kingdom	Carlisle, UK	EUR|UK|UK001|CARLISLE
United Kingdom	Chelmsford, UK	EUR|UK|UK001|CHELMSFORD
United Kingdom	Cheltenham, UK	EUR|UK|UK001|CHELTENHAM
United Kingdom	Chester, UK	EUR|UK|UK001|CHESTER
United Kingdom	Chesterfield, UK	EUR|UK|UK001|CHESTERFIELD
United Kingdom	Chichester, UK	EUR|UK|UK001|CHICHESTER
United Kingdom	Colchester, UK	EUR|UK|UK001|COLCHESTER
United Kingdom	Conwy, UK	EUR|UK|UK004|CONWY
United Kingdom	Coventry, UK	EUR|UK|UK001|COVENTRY
United Kingdom	Crewe, UK	EUR|UK|UK001|CREWE
United Kingdom	Croydon, UK	EUR|UK|UK001|CROYDON
United Kingdom	Darlington, UK	EUR|UK|UK001|DARLINGTON
United Kingdom	Derby, UK	EUR|UK|UK001|DERBY
United Kingdom	Doncaster, UK	EUR|UK|UK001|DONCASTER
United Kingdom	Dover, UK	EUR|UK|UK001|DOVER
United Kingdom	Dudley, UK	EUR|UK|UK001|DUDLEY
United Kingdom	Dumfries and Galloway, UK	EUR|UK|UK002|DUMFRIES AND GALLOWAY
United Kingdom	Dundee, UK	EUR|UK|UK002|DUNDEE
United Kingdom	Ealing, UK	EUR|UK|UK001|EALING
United Kingdom	Eastleigh, UK	EUR|UK|UK001|EASTLEIGH
United Kingdom	Edinburgh, UK	EUR|UK|UK002|EDINBURGH
United Kingdom	Elmbridge, UK	EUR|UK|UK001|ELMBRIDGE

United Kingdom	Enfield, UK	EUR|UK|UK001|ENFIELD
United Kingdom	Exeter, UK	EUR|UK|UK001|EXETER
United Kingdom	Falkirk, UK	EUR|UK|UK002|FALKIRK
United Kingdom	Fareham, UK	EUR|UK|UK001|FAREHAM
United Kingdom	Gateshead, UK	EUR|UK|UK001|GATESHEAD
United Kingdom	Gedling, UK	EUR|UK|UK001|GEDLING
United Kingdom	Glasgow, UK	EUR|UK|UK002|GLASGOW
United Kingdom	Gloucester, UK	EUR|UK|UK001|GLOUCESTER
United Kingdom	Guildford, UK	EUR|UK|UK001|GUILDFORD
United Kingdom	Hackney, UK	EUR|UK|UK001|HACKNEY
United Kingdom	Halton, UK	EUR|UK|UK001|HALTON
United Kingdom	Hammersmith and Fulham, UK	EUR|UK|UK001|HAMMERSMITH AND FULHAM
United Kingdom	Haringey, UK	EUR|UK|UK001|HARINGEY
United Kingdom	Harrogate, UK	EUR|UK|UK001|HARROGATE
United Kingdom	Harrow, UK	EUR|UK|UK001|HARROW
United Kingdom	Havant, UK	EUR|UK|UK148|HAVANT
United Kingdom	Havant and Waterloo, UK	EUR|UK|UK001|HAVANT AND WATERLOO
United Kingdom	Havering, UK	EUR|UK|UK001|HAVERING
United Kingdom	Hillingdon, UK	EUR|UK|UK001|HILLINGDON
United Kingdom	Horsham, UK	EUR|UK|UK001|HORSHAM
United Kingdom	Hounslow, UK	EUR|UK|UK001|HOUNSLOW
United Kingdom	Ipswich, UK	EUR|UK|UK001|IPSWICH
United Kingdom	Islington, UK	EUR|UK|UK001|ISLINGTON
United Kingdom	Kensington and Chelsea, UK	EUR|UK|UK001|KENSINGTON AND CHELSEA
United Kingdom	Kings Lynn and West Norfolk, UK	EUR|UK|UK001|KINGS LYNN AND WEST NORFOLK
United Kingdom	Kingston-Upon-Hull, UK	EUR|UK|UK001|KINGSTON-UPON-HULL
United Kingdom	Kingston-Upon-Thames, UK	EUR|UK|UK001|KINGSTON-UPON-THAMES
United Kingdom	Kirklees, UK	EUR|UK|UK001|KIRKLEES
United Kingdom	Lambeth, UK	EUR|UK|UK001|LAMBETH
United Kingdom	Lancaster, UK	EUR|UK|UK001|LANCASTER
United Kingdom	Leeds, UK	EUR|UK|UK001|LEEDS
United Kingdom	Leicester, UK	EUR|UK|UK001|LEICESTER
United Kingdom	Lewisham, UK	EUR|UK|UK001|LEWISHAM
United Kingdom	Lisburn, UK	EUR|UK|UK002|LISBURN
United Kingdom	Liverpool, UK	EUR|UK|UK001|LIVERPOOL
United Kingdom	London, UK	EUR|UK|UK001|LONDON
United Kingdom	Luton, UK	EUR|UK|UK001|LUTON
United Kingdom	Macclesfield, UK	EUR|UK|UK001|MACCLESFIELD
United Kingdom	Maidstone, UK	EUR|UK|UK001|MAIDSTONE

United Kingdom	Manchester, UK	EUR|UK|UK001|MANCHESTER
United Kingdom	Mansfield, UK	EUR|UK|UK001|MANSFIELD
United Kingdom	Merton, UK	EUR|UK|UK001|MERTON
United Kingdom	Milton Keynes, UK	EUR|UK|UK001|MILTON KEYNES
United Kingdom	Newbury, UK	EUR|UK|UK001|NEWBURY
United Kingdom	Newcastle-Under-Lyme, UK	EUR|UK|UK001|NEWCASTLE-UNDER-LYME
United Kingdom	Newcastle-Upon-Tyne, UK	EUR|UK|UK001|NEWCASTLE-UPON-TYNE
United Kingdom	Newham, UK	EUR|UK|UK001|NEWHAM
United Kingdom	Newport, UK	EUR|UK|UK001|NEWPORT
United Kingdom	Northampton, UK	EUR|UK|UK001|NORTHAMPTON
United Kingdom	Norwich, UK	EUR|UK|UK001|NORWICH
United Kingdom	Nottingham, UK	EUR|UK|UK001|NOTTINGHAM
United Kingdom	Nuneaton, UK	EUR|UK|UK238|NUNEATON
United Kingdom	Nuneaton and Bedworth, UK	EUR|UK|UK001|NUNEATON AND BEDWORTH
United Kingdom	Oldham, UK	EUR|UK|UK001|OLDHAM
United Kingdom	Oxford, UK	EUR|UK|UK001|OXFORD
United Kingdom	Peterborough, UK	EUR|UK|UK001|PETERBOROUGH
United Kingdom	Plymouth, UK	EUR|UK|UK001|PLYMOUTH
United Kingdom	Poole, UK	EUR|UK|UK001|POOLE
United Kingdom	Portsmouth, UK	EUR|UK|UK001|PORTSMOUTH
United Kingdom	Preston, UK	EUR|UK|UK001|PRESTON
United Kingdom	Reading, UK	EUR|UK|UK001|READING
United Kingdom	Redbridge, UK	EUR|UK|UK001|REDBRIDGE
United Kingdom	Reigate, UK	EUR|UK|UK224|REIGATE
United Kingdom	Reigate and Banstead, UK	EUR|UK|UK001|REIGATE AND BANSTEAD
United Kingdom	Rhondda Cynon Taff, UK	EUR|UK|UK004|RHONDDA CYNON TAFF
United Kingdom	Rochdale, UK	EUR|UK|UK001|ROCHDALE
United Kingdom	Rotherham, UK	EUR|UK|UK001|ROTHERHAM
United Kingdom	Salford, UK	EUR|UK|UK001|SALFORD
United Kingdom	Salisbury, UK	EUR|UK|UK001|SALISBURY
United Kingdom	Sandwell, UK	EUR|UK|UK001|SANDWELL
United Kingdom	Scarborough, UK	EUR|UK|UK001|SCARBOROUGH
United Kingdom	Sefton, UK	EUR|UK|UK001|SEFTON
United Kingdom	Sevenoaks, UK	EUR|UK|UK001|SEVENOAKS
United Kingdom	Sheffield, UK	EUR|UK|UK001|SHEFFIELD
United Kingdom	Slough, UK	EUR|UK|UK001|SLOUGH
United Kingdom	Solihull, UK	EUR|UK|UK001|SOLIHULL
United Kingdom	Southampton, UK	EUR|UK|UK001|SOUTHAMPTON
United Kingdom	Southend-On-Sea, UK	EUR|UK|UK001|SOUTHEND-ON-SEA
United Kingdom	Southwark, UK	EUR|UK|UK001|SOUTHWARK
United Kingdom	St Albans, UK	EUR|UK|UK001|ST ALBANS

United Kingdom	St Helens, UK	EUR|UK|UK001|ST HELENS
United Kingdom	Stafford, UK	EUR|UK|UK001|STAFFORD
United Kingdom	Stockport, UK	EUR|UK|UK001|STOCKPORT
United Kingdom	Stockton-On-Tees, UK	EUR|UK|UK001|STOCKTON-ON-TEES
United Kingdom	Stoke-On-Trent, UK	EUR|UK|UK001|STOKE-ON-TRENT
United Kingdom	Stratford-On-Avon, UK	EUR|UK|UK001|STRATFORD-ON-AVON
United Kingdom	Stroud, UK	EUR|UK|UK001|STROUD
United Kingdom	Sunderland, UK	EUR|UK|UK001|SUNDERLAND
United Kingdom	Sutton, UK	EUR|UK|UK001|SUTTON
United Kingdom	Swansea, UK	EUR|UK|UK004|SWANSEA
United Kingdom	Tendring, UK	EUR|UK|UK001|TENDRING
United Kingdom	Thamesdown, UK	EUR|UK|UK001|THAMESDOWN
United Kingdom	Thanet, UK	EUR|UK|UK001|THANET
United Kingdom	Tonbridge, UK	EUR|UK|UK160|TONBRIDGE
United Kingdom	Tonbridge and Malling, UK	EUR|UK|UK001|TONBRIDGE AND MALLING
United Kingdom	Torbay, UK	EUR|UK|UK001|TORBAY
United Kingdom	Tunbridge Wells, UK	EUR|UK|UK001|TUNBRIDGE WELLS
United Kingdom	Wakefield, UK	EUR|UK|UK001|WAKEFIELD
United Kingdom	Walsall, UK	EUR|UK|UK001|WALSALL
United Kingdom	Warrington, UK	EUR|UK|UK001|WARRINGTON
United Kingdom	Warwick, UK	EUR|UK|UK001|WARWICK
United Kingdom	Waterloo, UK	EUR|UK|UK148|WATERLOO
United Kingdom	Westminster, UK	EUR|UK|UK001|WESTMINSTER
United Kingdom	Wigan, UK	EUR|UK|UK001|WIGAN
United Kingdom	Winchester, UK	EUR|UK|UK001|WINCHESTER
United Kingdom	Windsor and Maidenhead, UK	EUR|UK|UK001|WINDSOR AND MAIDENHEAD
United Kingdom	Wirral, UK	EUR|UK|UK001|WIRRAL
United Kingdom	Wokingham, UK	EUR|UK|UK001|WOKINGHAM
United Kingdom	Wolverhampton, UK	EUR|UK|UK001|WOLVERHAMPTON
United Kingdom	Wycombe, UK	EUR|UK|UK001|WYCOMBE
United Kingdom	York, UK	EUR|UK|UK001|YORK
United States	Abilene, TX, US	NAM|US|TX|ABILENE
United States	Akron, OH, US	NAM|US|OH|AKRON
United States	Albany, NY, US	NAM|US|NY|ALBANY
United States	Albuquerque, NM, US	NAM|US|NM|ALBUQUERQUE
United States	Alexandria, VA, US	NAM|US|VA|ALEXANDRIA
United States	Allentown, PA, US	NAM|US|PA|ALLENTOWN
United States	Amarillo, TX, US	NAM|US|TX|AMARILLO
United States	Anaheim, CA, US	NAM|US|CA|ANAHEIM
United States	Anchorage, AK, US	NAM|US|AK|ANCHORAGE
United States	Ann Arbor, MI, US	NAM|US|MI|ANN ARBOR

United States	Annapolis, MD, US	NAM|US|MD|ANNAPOLIS
United States	Arlington, VA, US	NAM|US|VA|ARLINGTON
United States	Arlington, TX, US	NAM|US|TX|ARLINGTON
United States	Arvada, CO, US	NAM|US|CO|ARVADA
United States	Athens, GA, US	NAM|US|GA|ATHENS
United States	Atlanta, GA, US	NAM|US|GA|ATLANTA
United States	Augusta, GA, US	NAM|US|GA|AUGUSTA
United States	Aurora, CO, US	NAM|US|CO|AURORA
United States	Aurora, IL, US	NAM|US|IL|AURORA
United States	Austin, TX, US	NAM|US|TX|AUSTIN
United States	Bakersfield, CA, US	NAM|US|CA|BAKERSFIELD
United States	Baltimore, MD, US	NAM|US|MD|BALTIMORE
United States	Baton Rouge, LA, US	NAM|US|LA|BATON ROUGE
United States	Beaumont, TX, US	NAM|US|TX|BEAUMONT
United States	Bellevue, WA, US	NAM|US|WA|BELLEVUE
United States	Berkeley, CA, US	NAM|US|CA|BERKELEY
United States	Birmingham, AL, US	NAM|US|AL|BIRMINGHAM
United States	Bismarck, ND, US	NAM|US|ND|BISMARCK
United States	Boise, ID, US	NAM|US|ID|BOISE
United States	Boston, MA, US	NAM|US|MA|BOSTON
United States	Bridgeport, CT, US	NAM|US|CT|BRIDGEPORT
United States	Brownsville, TX, US	NAM|US|TX|BROWNSVILLE
United States	Buffalo, NY, US	NAM|US|NY|BUFFALO
United States	Burbank, CA, US	NAM|US|CA|BURBANK
United States	Cambridge, MA, US	NAM|US|MA|CAMBRIDGE
United States	Cape Coral, FL, US	NAM|US|FL|CAPE CORAL
United States	Carrollton, TX, US	NAM|US|TX|CARROLLTON
United States	Carson City, NV, US	NAM|US|NV|CARSON CITY
United States	Casper, WY, US	NAM|US|WY|CASPER
United States	Cedar Rapids, IA, US	NAM|US|IA|CEDAR RAPIDS
United States	Chandler, AZ, US	NAM|US|AZ|CHANDLER
United States	Charleston, WV, US	NAM|US|WV|Charleston
United States	Charleston, SC, US	NAM|US|SC|Charleston
United States	Charlotte, NC, US	NAM|US|NC|CHARLOTTE
United States	Chattanooga, TN, US	NAM|US|TN|CHATTANOOGA
United States	Chesapeake, VA, US	NAM|US|VA|CHESAPEAKE
United States	Cheyenne, WY, US	NAM|US|WY|CHEYENNE
United States	Chicago, IL, US	NAM|US|IL|CHICAGO
United States	Chula Vista, CA, US	NAM|US|CA|CHULA VISTA
United States	Cincinnati, OH, US	NAM|US|OH|CINCINNATI
United States	Clarksville, TN, US	NAM|US|TN|CLARKSVILLE
United States	Clearwater, FL, US	NAM|US|FL|CLEARWATER
United States	Cleveland, OH, US	NAM|US|OH|CLEVELAND

United States	Colorado Springs, CO, US	NAM|US|CO|COLORADO SPRINGS
United States	Columbia, SC, US	NAM|US|SC|COLUMBIA
United States	Columbus, OH, US	NAM|US|OH|COLUMBUS
United States	Columbus, GA, US	NAM|US|GA|COLUMBUS
United States	Concord, CA, US	NAM|US|CA|CONCORD
United States	Coral Springs, FL, US	NAM|US|FL|CORAL SPRINGS
United States	Corona, CA, US	NAM|US|CA|CORONA
United States	Corpus Christi, TX, US	NAM|US|TX|CORPUS CHRISTI
United States	Costa Mesa, CA, US	NAM|US|CA|COSTA MESA
United States	Dallas, TX, US	NAM|US|TX|DALLAS
United States	Daly City, CA, US	NAM|US|CA|DALY CITY
United States	Dayton, OH, US	NAM|US|OH|DAYTON
United States	Denver, CO, US	NAM|US|CO|DENVER
United States	Des Moines, IA, US	NAM|US|IA|DES MOINES
United States	Detroit, MI, US	NAM|US|MI|DETROIT
United States	Dothan, AL, US	NAM|US|AL|Dothan
United States	Dover, CO, US	NAM|US|CO|DOVER
United States	Dover, DE, US	NAM|US|DE|DOVER
United States	Downey, CA, US	NAM|US|CA|DOWNEY
United States	Durham, NC, US	NAM|US|NC|DURHAM
United States	Eau Claire, WI, US	NAM|US|WI|Eau Claire
United States	El Monte, CA, US	NAM|US|CA|EL MONTE
United States	El Paso, TX, US	NAM|US|TX|EL PASO
United States	Elizabeth, NJ, US	NAM|US|NJ|ELIZABETH
United States	Elk Grove, CA, US	NAM|US|CA|ELK GROVE
United States	Erie, PA, US	NAM|US|PA|ERIE
United States	Escondido, CA, US	NAM|US|CA|ESCONDIDO
United States	Eugene, OR, US	NAM|US|OR|EUGENE
United States	Evansville, IN, US	NAM|US|IN|EVANSVILLE
United States	Fayetteville, NC, US	NAM|US|NC|FAYETTEVILLE
United States	Fayetteville, AR, US	NAM|US|AR|Fayetteville
United States	Flint, MI, US	NAM|US|MI|FLINT
United States	Fontana, CA, US	NAM|US|CA|FONTANA
United States	Fort Collins, CO, US	NAM|US|CO|FORT COLLINS
United States	Fort Lauderdale, FL, US	NAM|US|FL|FORT LAUDERDALE
United States	Fort Wayne, IN, US	NAM|US|IN|FORT WAYNE
United States	Fort Worth, TX, US	NAM|US|TX|FORT WORTH
United States	Frankfort, KY, US	NAM|US|KY|FRANKFORT
United States	Fremont, CA, US	NAM|US|CA|FREMONT
United States	Fresno, CA, US	NAM|US|CA|FRESNO
United States	Fullerton, CA, US	NAM|US|CA|FULLERTON
United States	Gainesville, FL, US	NAM|US|FL|Gainesville
United States	Garden Grove, CA, US	NAM|US|CA|GARDEN GROVE

United States	Garland, TX, US	NAM|US|TX|GARLAND
United States	Gary, IN, US	NAM|US|IN|GARY
United States	Gilbert, AZ, US	NAM|US|AZ|GILBERT
United States	Gillette, NJ, US	NAM|US|NJ|GILLETTE
United States	Gillette, WY, US	NAM|US|WY|GILLETTE
United States	Glendale, CA, US	NAM|US|CA|GLENDALE
United States	Grand Island, NE, US	NAM|US|NE|Grand Island
United States	Grand Prairie, TX, US	NAM|US|TX|GRAND PRAIRIE
United States	Grand Rapids, MI, US	NAM|US|MI|GRAND RAPIDS
United States	Green Bay, WI, US	NAM|US|WI|GREEN BAY
United States	Greensboro, NC, US	NAM|US|NC|GREENSBORO
United States	Hampton, VA, US	NAM|US|VA|HAMPTON
United States	Harrisburg, PA, US	NAM|US|PA|HARRISBURG
United States	Hartford, CT, US	NAM|US|CT|HARTFORD
United States	Hattiesburg, MS, US	NAM|US|MS|Hattiesburg
United States	Hayward, CA, US	NAM|US|CA|HAYWARD
United States	Helena, MT, US	NAM|US|MT|HELENA
United States	Henderson, NV, US	NAM|US|NV|HENDERSON
United States	Hialeah, FL, US	NAM|US|FL|HIALEAH
United States	Hollywood, FL, US	NAM|US|FL|HOLLYWOOD
United States	Honolulu, HI, US	NAM|US|HI|HONOLULU
United States	Houston, TX, US	NAM|US|TX|HOUSTON
United States	Huntington Beach, CA, US	NAM|US|CA|HUNTINGTON BEACH
United States	Huntsville, AL, US	NAM|US|AL|HUNTSVILLE
United States	Independence, MO, US	NAM|US|MO|INDEPENDENCE
United States	Indianapolis, IN, US	NAM|US|IN|INDIANAPOLIS
United States	Inglewood, CA, US	NAM|US|CA|INGLEWOOD
United States	Irvine, CA, US	NAM|US|CA|IRVINE
United States	Irving, TX, US	NAM|US|TX|IRVING
United States	Jackson, MS, US	NAM|US|MS|JACKSON
United States	Jackson, WY, US	NAM|US|WY|JACKSON
United States	Jackson, MI, US	NAM|US|MI|Jackson
United States	Jacksonville, FL, US	NAM|US|FL|JACKSONVILLE
United States	Jefferson City, MO, US	NAM|US|MO|JEFFERSON CITY
United States	Jersey City, NJ, US	NAM|US|NJ|JERSEY CITY
United States	Joliet, IL, US	NAM|US|IL|JOLIET
United States	Juneau, AK, US	NAM|US|AK|JUNEAU
United States	Kansas City, MO, US	NAM|US|MO|KANSAS CITY
United States	Kansas City, KS, US	NAM|US|KS|KANSAS CITY
United States	Knoxville, TN, US	NAM|US|TN|KNOXVILLE
United States	Lafayette, LA, US	NAM|US|LA|LAFAYETTE
United States	Lakewood, CO, US	NAM|US|CO|LAKEWOOD
United States	Lancaster, CA, US	NAM|US|CA|LANCASTER

United States	Lansing, MI, US	NAM|US|MI|LANSING
United States	Laramie, WY, US	NAM|US|WY|LARAMIE
United States	Laredo, TX, US	NAM|US|TX|LAREDO
United States	Las Vegas, NV, US	NAM|US|NV|LAS VEGAS
United States	Lexington, KY, US	NAM|US|KY|LEXINGTON
United States	Lincoln, NE, US	NAM|US|NE|LINCOLN
United States	Little Rock, AR, US	NAM|US|AR|LITTLE ROCK
United States	Livonia, MI, US	NAM|US|MI|LIVONIA
United States	Long Beach, CA, US	NAM|US|CA|LONG BEACH
United States	Los Angeles, CA, US	NAM|US|CA|LOS ANGELES
United States	Louisville, KY, US	NAM|US|KY|LOUISVILLE
United States	Lowell, MA, US	NAM|US|MA|LOWELL
United States	Lubbock, TX, US	NAM|US|TX|LUBBOCK
United States	Madison, WI, US	NAM|US|WI|MADISON
United States	Manchester, NH, US	NAM|US|NH|MANCHESTER
United States	Mcallen, TX, US	NAM|US|TX|MCALLEN
United States	Memphis, TN, US	NAM|US|TN|MEMPHIS
United States	Mesa, AZ, US	NAM|US|AZ|MESA
United States	Mesquite, TX, US	NAM|US|TX|MESQUITE
United States	Miami, FL, US	NAM|US|FL|MIAMI
United States	Milwaukee, WI, US	NAM|US|WI|MILWAUKEE
United States	Minneapolis, MN, US	NAM|US|MN|MINNEAPOLIS
United States	Mobile, AL, US	NAM|US|AL|MOBILE
United States	Modesto, CA, US	NAM|US|CA|MODESTO
United States	Montgomery, AL, US	NAM|US|AL|MONTGOMERY
United States	Montpelier, VT, US	NAM|US|VT|MONTPELIER
United States	Moreno Valley, CA, US	NAM|US|CA|MORENO VALLEY
United States	Myrtle Beach, SC, US	NAM|US|SC|Myrtle Beach
United States	Naperville, IL, US	NAM|US|IL|NAPERVILLE
United States	Nashville, TN, US	NAM|US|TN|NASHVILLE
United States	New Haven, CT, US	NAM|US|CT|NEW HAVEN
United States	New Orleans, LA, US	NAM|US|LA|NEW ORLEANS
United States	New York, NY, US	NAM|US|NY|NEW YORK
United States	Newark, NJ, US	NAM|US|NJ|NEWARK
United States	Newport News, VA, US	NAM|US|VA|NEWPORT NEWS
United States	Norfolk, VA, US	NAM|US|VA|NORFOLK
United States	North Las Vegas, NV, US	NAM|US|NV|NORTH LAS VEGAS
United States	Norwalk, CA, US	NAM|US|CA|NORWALK
United States	Oakland, CA, US	NAM|US|CA|OAKLAND
United States	Oceanside, CA, US	NAM|US|CA|OCEANSIDE
United States	Oklahoma City, OK, US	NAM|US|OK|OKLAHOMA CITY
United States	Olympia, WA, US	NAM|US|WA|OLYMPIA
United States	Omaha, NE, US	NAM|US|NE|OMAHA

United States	Ontario, CA, US	NAM|US|CA|ONTARIO
United States	Orange, CA, US	NAM|US|CA|ORANGE
United States	Orlando, FL, US	NAM|US|FL|ORLANDO
United States	Overland Park, KS, US	NAM|US|KS|OVERLAND PARK
United States	Oxnard, CA, US	NAM|US|CA|OXNARD
United States	Palmdale, CA, US	NAM|US|CA|PALMDALE
United States	Panama City, FL, US	NAM|US|FL|Panama City
United States	Pasadena, CA, US	NAM|US|CA|PASADENA
United States	Pasadena, TX, US	NAM|US|TX|PASADENA
United States	Paterson, NJ, US	NAM|US|NJ|PATERSON
United States	Pembroke Pines, FL, US	NAM|US|FL|PEMBROKE PINES
United States	Peoria, IL, US	NAM|US|IL|PEORIA
United States	Philadelphia, PA, US	NAM|US|PA|PHILADELPHIA
United States	Phoenix, AZ, US	NAM|US|AZ|PHOENIX
United States	Pierre, SD, US	NAM|US|SD|PIERRE
United States	Pittsburgh, PA, US	NAM|US|PA|PITTSBURGH
United States	Plano, TX, US	NAM|US|TX|PLANO
United States	Pomona, CA, US	NAM|US|CA|POMONA
United States	Port Saint Lucie, FL, US	NAM|US|FL|PORT SAINT LUCIE
United States	Portland, OR, US	NAM|US|OR|PORTLAND
United States	Portsmouth, VA, US	NAM|US|VA|PORTSMOUTH
United States	Providence, RI, US	NAM|US|RI|PROVIDENCE
United States	Provo, UT, US	NAM|US|UT|PROVO
United States	Pueblo, CO, US	NAM|US|CO|PUEBLO
United States	Raleigh, NC, US	NAM|US|NC|RALEIGH
United States	Rancho Cucamonga, CA, US	NAM|US|CA|RANCHO CUCAMONGA
United States	Reno, NV, US	NAM|US|NV|RENO
United States	Richmond, VA, US	NAM|US|VA|RICHMOND
United States	Riverside, CA, US	NAM|US|CA|RIVERSIDE
United States	Rochester, NY, US	NAM|US|NY|ROCHESTER
United States	Rock Springs, MD, US	NAM|US|MD|ROCK SPRINGS
United States	Rock Springs, WY, US	NAM|US|WY|ROCK SPRINGS
United States	Rockford, IL, US	NAM|US|IL|ROCKFORD
United States	Roswell, NM, US	NAM|US|NM|Roswell
United States	Sacramento, CA, US	NAM|US|CA|SACRAMENTO
United States	Saint Louis, MO, US	NAM|US|MO|SAINT LOUIS
United States	Saint Paul, MN, US	NAM|US|MN|SAINT PAUL
United States	Salem, OR, US	NAM|US|OR|SALEM
United States	Salinas, CA, US	NAM|US|CA|SALINAS
United States	Salt Lake City, UT, US	NAM|US|UT|SALT LAKE CITY
United States	San Antonio, TX, US	NAM|US|TX|SAN ANTONIO
United States	San Bernardino, CA, US	NAM|US|CA|SAN BERNARDINO
United States	San Diego, CA, US	NAM|US|CA|SAN DIEGO

United States	San Francisco, CA, US	NAM|US|CA|SAN FRANCISCO
United States	San Jose, CA, US	NAM|US|CA|SAN JOSE
United States	Santa Ana, CA, US	NAM|US|CA|SANTA ANA
United States	Santa Clara, CA, US	NAM|US|CA|SANTA CLARA
United States	Santa Clarita, CA, US	NAM|US|CA|SANTA CLARITA
United States	Santa Fe, NM, US	NAM|US|NM|SANTA FE
United States	Santa Rosa, CA, US	NAM|US|CA|SANTA ROSA
United States	Savannah, GA, US	NAM|US|GA|SAVANNAH
United States	Scottsdale, AZ, US	NAM|US|AZ|SCOTTSDALE
United States	Seattle, WA, US	NAM|US|WA|SEATTLE
United States	Shreveport, LA, US	NAM|US|LA|SHREVEPORT
United States	Simi Valley, CA, US	NAM|US|CA|SIMI VALLEY
United States	Sioux Falls, SD, US	NAM|US|SD|SIOUX FALLS
United States	South Bend, IN, US	NAM|US|IN|SOUTH BEND
United States	Spokane, WA, US	NAM|US|WA|SPOKANE
United States	Springfield, IL, US	NAM|US|IL|SPRINGFIELD
United States	Springfield, MA, US	NAM|US|MA|SPRINGFIELD
United States	Springfield, MO, US	NAM|US|MO|SPRINGFIELD
United States	St Petersburg, FL, US	NAM|US|FL|ST PETERSBURG
United States	Stamford, CT, US	NAM|US|CT|STAMFORD
United States	Steamboat Springs, CO, US	NAM|US|CO|STEAMBOAT SPRINGS
United States	Sterling Heights, MI, US	NAM|US|MI|STERLING HEIGHTS
United States	Stockton, CA, US	NAM|US|CA|STOCKTON
United States	Sunnyvale, CA, US	NAM|US|CA|SUNNYVALE
United States	Syracuse, NY, US	NAM|US|NY|SYRACUSE
United States	Tacoma, WA, US	NAM|US|WA|TACOMA
United States	Tallahassee, FL, US	NAM|US|FL|TALLAHASSEE
United States	Tampa, FL, US	NAM|US|FL|TAMPA
United States	Tempe, AZ, US	NAM|US|AZ|TEMPE
United States	Thousand Oaks, CA, US	NAM|US|CA|THOUSAND OAKS
United States	Toledo, OH, US	NAM|US|OH|TOLEDO
United States	Topeka, KS, US	NAM|US|KS|TOPEKA
United States	Torrance, CA, US	NAM|US|CA|TORRANCE
United States	Traverse City, MI, US	NAM|US|MI|Traverse City
United States	Trenton, NJ, US	NAM|US|NJ|TRENTON
United States	Tucson, AZ, US	NAM|US|AZ|TUCSON
United States	Tulsa, OK, US	NAM|US|OK|TULSA
United States	Valdosta, GA, US	NAM|US|GA|Valdosta
United States	Vallejo, CA, US	NAM|US|CA|VALLEJO
United States	Vancouver, WA, US	NAM|US|WA|VANCOUVER
United States	Ventura, CA, US	NAM|US|CA|VENTURA
United States	Virginia Beach, VA, US	NAM|US|VA|VIRGINIA BEACH
United States	Waco, TX, US	NAM|US|TX|WACO

United States	Warren, MI, US	NAM|US|MI|WARREN
United States	Washington, DC, US	NAM|US|DC|WASHINGTON
United States	Waterbury, CT, US	NAM|US|CT|WATERBURY
United States	West Covina, CA, US	NAM|US|CA|WEST COVINA
United States	West Valley City, UT, US	NAM|US|UT|WEST VALLEY CITY
United States	Westminster, CO, US	NAM|US|CO|WESTMINSTER
United States	Wichita, KS, US	NAM|US|KS|WICHITA
United States	Wichita Falls, TX, US	NAM|US|TX|WICHITA FALLS
United States	Winston-Salem, NC, US	NAM|US|NC|WINSTON-SALEM
United States	Worcester, MA, US	NAM|US|MA|WORCESTER
United States	Yonkers, NY, US	NAM|US|NY|YONKERS
Uruguay	Montevideo, UY	SAM|UY|UY010|MONTEVIDEO
Uzbekistan	Almalyk, UZ	ASI|UZ|UZ013|ALMALYK
Uzbekistan	Andizhan, UZ	ASI|UZ|UZ001|ANDIZHAN
Uzbekistan	Angren, UZ	ASI|UZ|UZ013|ANGREN
Uzbekistan	Bukhara, UZ	ASI|UZ|UZ002|BUKHARA
Uzbekistan	Chirchik, UZ	ASI|UZ|UZ013|CHIRCHIK
Uzbekistan	Fergana, UZ	ASI|UZ|UZ003|FERGANA
Uzbekistan	Karshi, UZ	ASI|UZ|UZ008|KARSHI
Uzbekistan	Kokand, UZ	ASI|UZ|UZ003|KOKAND
Uzbekistan	Margilan, UZ	ASI|UZ|UZ003|MARGILAN
Uzbekistan	Namangan, UZ	ASI|UZ|UZ006|NAMANGAN
Uzbekistan	Navoi, UZ	ASI|UZ|UZ007|NAVOI
Uzbekistan	Nukus, UZ	ASI|UZ|UZ009|NUKUS
Uzbekistan	Samarkand, UZ	ASI|UZ|UZ010|SAMARKAND
Uzbekistan	Tashkent, UZ	ASI|UZ|UZ013|TASHKENT
Uzbekistan	Termez, UZ	ASI|UZ|UZ012|TERMEZ
Vanuatu	Vila, VU	OCN|VU|NH009|VILA
Vatican City	Vatican City, VA	EUR|VA|-|VATICAN CITY
Venezuela	Acarigua-Araure, VE	SAM|VE|VE019|ACARIGUA-ARAURE
Venezuela	Barcelona, VE	SAM|VE|VE002|BARCELONA
Venezuela	Barinas, VE	SAM|VE|VE005|BARINAS
Venezuela	Barquisimeto, VE	SAM|VE|VE014|BARQUISIMETO
Venezuela	Baruta, VE	SAM|VE|VE016|BARUTA
Venezuela	Bolivar, VE	SAM|VE|VE006|CIUDAD BOLÍVAR
Venezuela	Cabimas, VE	SAM|VE|VE025|CABIMAS
Venezuela	Caracas, VE	SAM|VE|VE011|CARACAS
Venezuela	Carupano, VE	SAM|VE|VE020|CARÚPANO
Venezuela	Catia La Mar, VE	SAM|VE|VE011|CATIA LA MAR
Venezuela	Ciudad Guayana, VE	SAM|VE|VE006|CIUDAD GUAYANA
Venezuela	Coro, VE	SAM|VE|VE012|CORO
Venezuela	Cumana, VE	SAM|VE|VE020|CUMANÁ
Venezuela	Guanare, VE	SAM|VE|VE019|GUANARE

Venezuela	Guarenas, VE	SAM|VE|VE016|GUARENAS
Venezuela	La Victoria, VE	SAM|VE|VE004|LA VICTORIA
Venezuela	Lagunillas, VE	SAM|VE|VE015|LAGUNILLAS
Venezuela	Los Teques, VE	SAM|VE|VE016|LOS TEQUES
Venezuela	Maracaibo, VE	SAM|VE|VE025|MARACAIBO
Venezuela	Maracay, VE	SAM|VE|VE004|MARACAY
Venezuela	Maturin, VE	SAM|VE|VE017|MATURÍN
Venezuela	Merida, VE	SAM|VE|VE015|MÉRIDA
Venezuela	Petare, VE	SAM|VE|VE016|PETARE
Venezuela	Puerto Cabello, VE	SAM|VE|VE007|PUERTO CABELLO
Venezuela	Punto Fijo, VE	SAM|VE|VE012|PUNTO FIJO
Venezuela	San Cristobal, VE	SAM|VE|VE021|SAN CRISTÓBAL
Venezuela	Turmero, VE	SAM|VE|VE002|TURMERO
Venezuela	Valencia, VE	SAM|VE|VE007|VALENCIA
Venezuela	Valera, VE	SAM|VE|VE022|VALERA
Vietnam	Campha, VN	ASI|VN|VM052|CAMPHA
Vietnam	Cantho, VN	ASI|VN|VM041|CANTHO
Vietnam	Da Nang, VN	ASI|VN|VM016|DA NANG
Vietnam	Dalat, VN	ASI|VN|VM037|DALAT
Vietnam	Haiphong, VN	ASI|VN|VM029|HAIPHONG
Vietnam	Hanoi, VN	ASI|VN|VM017|HANOI
Vietnam	Ho Chi Minh City, VN	ASI|VN|VM060|HO CHI MINH CITY
Vietnam	Hon Gai, VN	ASI|VN|VM052|HON GAI
Vietnam	Hue, VN	ASI|VN|VM044|HUÉ
Vietnam	Longxuyen, VN	ASI|VN|VM060|LONGXUYEN
Vietnam	Mytho, VN	ASI|VN|VM059|MYTHO
Vietnam	Namdinh, VN	ASI|VN|VM042|NAMDINH
Vietnam	Nhatrang, VN	ASI|VN|VM011|NHATRANG
Vietnam	Qui Nhon, VN	ASI|VN|VM019|QUI NHON
Vietnam	Rach Gia, VN	ASI|VN|VM060|RACH GIA
Vietnam	Thai Nguyen, VN	ASI|VN|VM057|THAI NGUYEN
Vietnam	Vinh, VN	ASI|VN|VM060|VINH
Western Sahara	El Aaiun, EH	AFR|EH|WI---|EL AAIUN
Yemen	Aden, YE	MEA|YE|YM001|ADEN
Yemen	Hodeidah, YE	MEA|YE|YM004|HODEIDAH
Yemen	Sanaa, YE	MEA|YE|YM000|SANAA
Yemen	Taiz, YE	MEA|YE|YM008|TAIZ
Zambia	Chingola, ZM	AFR|ZM|ZA001|CHINGOLA
Zambia	Kabwe, ZM	AFR|ZM|ZA007|KABWE
Zambia	Kitwe, ZM	AFR|ZM|ZA001|KITWE
Zambia	Luanshya, ZM	AFR|ZM|ZA001|LUANSHYA
Zambia	Lusaka, ZM	AFR|ZM|ZA000|LUSAKA
Zambia	Mufulira, ZM	AFR|ZM|ZA001|MUFULIRA

Zambia	Ndola, ZM	AFR|ZM|ZA001|NDOLA
Zimbabwe	Bulawayo, ZW	AFR|ZW|ZI005|BULAWAYO
Zimbabwe	Chitungwiza, ZW	AFR|ZW|ZI003|CHITUNGWIZA
Zimbabwe	Gweru, ZW	AFR|ZW|ZI000|GWERU
Zimbabwe	Harare, ZW	AFR|ZW|ZI003|HARARE
Zimbabwe	Mutare, ZW	AFR|ZW|ZI000|MUTARE

12 Rain8 Hardware Setup

12.1 Rain8 Net

The Rain8net is a modular 8-zone sprinkler controller module that is driven by a RS232 serial port. Additional units may be daisy chained to provide control and 24 VAC power to as many as 2040 irrigation zones from a single COM port.

A 12 position terminal strip is found on all modules. Connect the 24 VAC to only one module; the remaining modules are powered by means of the 8-conductor network cable.

There is a single RS232 connection between the controlling computer and the "master" Rain8. The 24VAC power and network communications are transferred from master to slave-to-slave etc.

If the Rain8Net is used in a multi-master configuration, such as when the valve clusters are in locations where it is easier to run two connections from the PC than to run a connection between the two valve clusters. A remote connection such as using an IP/RS232 adapter may be a situation where this is appropriate.

The network connection for the slave units is an 8 conductor RJ45. Each slave has a pair of these modular jacks to pass on data and power to the next one in a daisy chain. Each slave also has a RS232 connection that is used only to assign the address during the initial configuration.

12.1.1 Equipment List

Initial Module

1. Rain8net controller with detachable terminal block in place.
2. 24VAC transformer
3. RS232 Cable with DB9 Connectors

Expansion / Slave Module(s)

1. Rain8net controller with detachable terminal block in place.
2. Network cable, item 10004

Interface Components

Serial Surge Protection

12.1.2 Installation

Controller Location

- Select a mounting location that is close to an electrical outlet and the valve wires that will connect to it.
- The controller should not be exposed to water. If used outside, it is necessary to provide a weather proof housing for your Rain8. http://www.wgldesigns.com/r8outdoor.html
- Mount your controller to a smooth dry surface by means of the enclosed Velcro strips.

Wiring the Valves

- If the maximum distance is less then 600 feet, use a single 20 gauge, plastic insulated wire for each valve.
- Each valve has two wires. One wire is designated as the common. All of the common valve wires can be connected together to one wire going to the controller.
- All connections should be made using wire nuts in grease caps to prevent corrosion.
- Only one valve should be connected to each zone.
- The rated output is 24 VAC at .25 amps (250ma), per zone. Some valves require a greater current then .25 amps to initially open and drop back to a lower value. This will present no problem as long as the drop back value is .25 amps or less.

Connecting the Valve Wires to the Controller

Determine which valve is to be connected to each zone. Insert each valve wire into its respective position on the terminal strip and gently tighten the setscrew.

Connect the common wire from the valves to the terminal labeled “common”.

Connecting the Counter/Switch Wires to the Controller

Connect the rain sensor or flow meter to terminals identified as “input” and second “24VAC”(#12).

Connecting the Transformer (Master unit only)

Connect the 24-VAC transformer to the two terminals labeled “24 VAC”. Note that this is required only on the first module installed as the power for additional units is supplied by means of the network connections.

Wiring the RS232 connection (Master unit only)

Connect the RS232 cable’s RJ11 plug to the RJ11 jack labeled “RS-232” on the left side of the module. The other end of the cable with the DB9 connector attaches to your computers serial port. The maximum allowed distance for this connection is 1000’.

It is strongly recommended that a RS232 Serial Surge Protector be installed on outdoor installations of the Rain8net

Available from http://www.tmanufacturing.com

Adding additional modules

As many as 254 additional 8 zone modules may be added by daisy chaining the modules “Rain8 Network Jacks”. See Figure 77.

Individual Rain8net modules are shipped set to an address of “1” and the default run timers disabled. For most eight zone, single module applications this is the desired configuration and the hardware installation is complete.

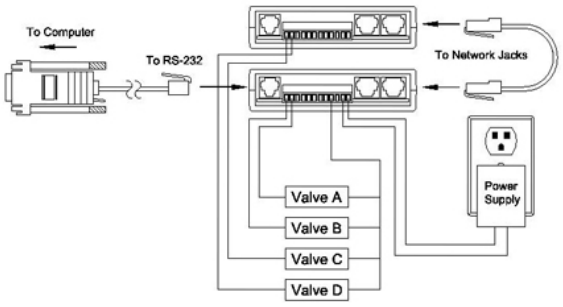


Figure 77 Rain8 Master and Expansion Wiring

Prepare to Configure the Rain8 module (only if you are installing multiple modules)

Please note that the Rain8 terminal strip is removable. Gently unplug the portion with screw heads from the socket mounted on the PCB. Remove the Rain8 from the wall and bring it to the location of the PC that will be used for programming.

Connect the DB9 cable and adapter into the RJ11 jack on the Rain8 labeled "RS-232". The DB9 end is plugged into a serial port on your PC. It is not necessary to provide power for the unit as it can derive what it needs for programming from the serial port.

It is very important that no attempt is made to program modules that are still connected to the network.

12.1.3 EPROM Programming for use with mcsSprinklers

Setup of the Rain8 EPROM is done from the Rain8 Setup page of mcsSprinklers. Figure 78 shows the setup parameters that are available. It can also be done with a Rain8Cfg.exe utility that is available from http://wgldesigns.com.

- At this point there is no need for anything to be connected to the Rain8 other than the serial cable. The power for the unit is derived from the serial port.
- Select the PC serial port that is connected to the Rain8
- Select desired address (1 – 255) for this module. Each module that is programmed must have a unique address. Convention is to start at 1 and proceed upward.
- Select the Enable Rain8 Timers checkbox so the Rain8 will turnoff each zone as a safety precaution
- Enter the timeout amount for each of the 8 valves. This value will be a few minutes longer than the longest that a zone will be run at any one time
- Click on the Write EPROM button to save the setup
- Click on the Read EPOM button to confirm the setup

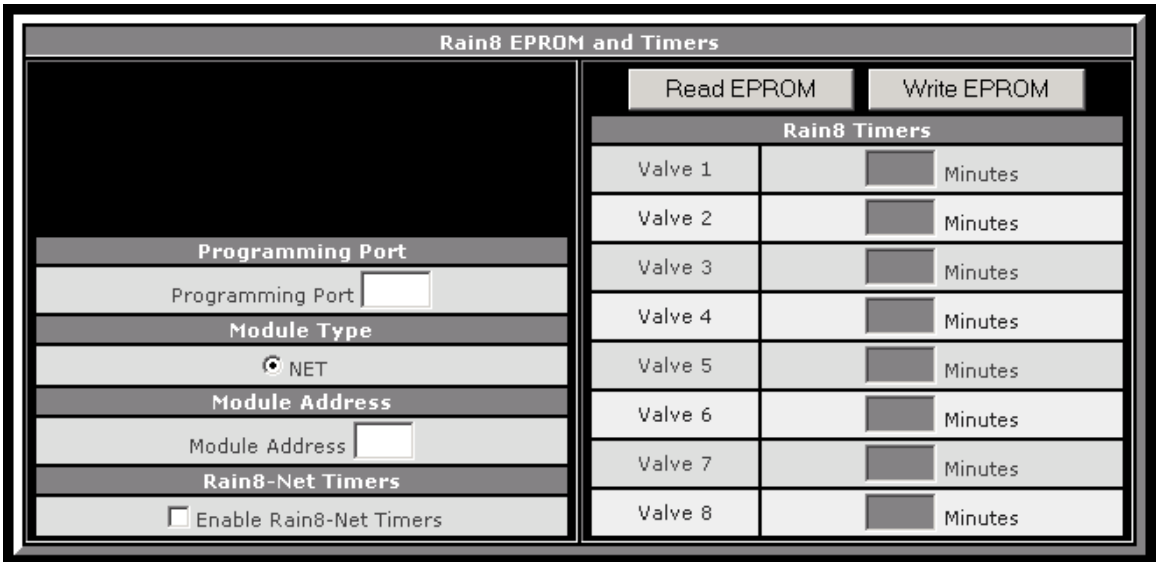


Figure 78 Rain8Net EPROM Setup

12.2 Rain8 Wireless

The Rain8wireless is an 8-zone irrigation controller capable of accepting X10 RF codes to control each zone.

12.2.1 Equipment List

Initial Module

1. Rain8 Wireless controller with detachable terminal block in place.
2. 24VAC transformer
3. RS232 Cable with DB9 Connectors
4. Coax Cable
5. Antenna and mounting bracket

Expansion / Slave Module(s)

1. Rain8 Wireless controller with detachable terminal block in place.
2. Network cable

Interface Components

CM17A X10 RF PC Interface

12.2.2 Installation

Controller Location

- Select a mounting location that is close to an electrical outlet and the valve wires that will connect to it.
- The controller should not be exposed to water. If used outside, it is necessary to provide weather proof housing for your Rain8. http://www.wgldesigns.com/r8outdoor.html
- Mount your controller to a smooth dry surface by means of the enclosed Velcro strips.

Connecting the Antenna

- Connect one end the RG6 coaxial cable to the F connector on the Rain8 module.
- Connect the other end to the quarter wave whip antenna.
- The antenna should me mounted on the furnished bracket at a location clear of interfering RF noise and metallic items like air handling ducts.

Wiring the Valves

- If the maximum distance is less then 600 feet, use a single 20 gauge, plastic insulated wire for each valve.
- Each valve has two wires. One wire is designated as the common. All of the common valve wires can be connected together to one wire going to the controller.
- All connections should be made using wire nuts in grease caps to prevent corrosion.
- Only one valve should be connected to each zone.
- The rated output is 24 VAC at .25 amps (250ma), per zone. Some valves require a greater current then .25 amps to initially open and drop back to a lower value. This will present no problem as long as the drop back value is .25 amps or less.

Connecting the Valve Wires to the Controller

- Determine which valve is to be connected to each zone. Insert each valve wire into its respective position on the terminal strip and gently tighten the setscrew.

- Connect the common wire from the valves to the terminal labeled “common”.

Connecting the Transformer & Interface

- Locate the two terminals labeled “24-vac in”. Connect the two transformer wires to these terminals.

Prepare to Program the Rain8 module

- Please note that the Rain8 terminal strip is removable. Gently unplug the portion with screw heads from the socket mounted on the PCB. Remove the Rain8 from the wall and bring it to the location of the PC that will be used for programming. Disconnect Antenna coax.

- Connect the Rain8wireless RJ11 RS232 jack on the left side of the housing to a serial (COM) port on your PC with the WGL 10002 cable.

- Important! At completion of programming, disconnect serial cable before reconnecting terminal strip and antenna.

12.2.3 EPROM Programming for use with mcsSprinklers

At this point **there should be nothing connected to the Rain8 other than the serial cable**. The power for the unit is derived from the serial port.

Setup of the Rain8 EPROM is done from the Rain8 Setup page of mcsSprinklers. Figure 78 shows the setup parameters that are available. It can also be done with a Rain8Cfg.exe utility that is available from http://wgldesigns.com.

Setup of the Rain8 EPROM is done from the Rain8 Setup page of mcsSprinklers. Figure 79 shows the setup parameters that are available. It can also be done with a Rain8Cfg.exe utility that is available from http://wgldesigns.com.

- At this point there is no need for anything to be connected to the Rain8 other than the serial cable. The power for the unit is derived from the serial port.

- Select the PC serial port that is connected to the Rain8

- Select desired address for this module. Each module that is programmed must have a unique address. The address consists of an X10 House code in the range “A” through “P” and one of two banks of eight unit codes.

- Select the Enable Rain8 Timers checkbox so the Rain8 will turnoff each zone as a safety precaution

- Enter the timeout amount for each of the 8 valves. This value will be a few minutes longer than the longest that a zone will be run at any one time

- The Rain8 Wireless can be configured so the 8th valve will turn ON when any of the other seven are ON. Since mcsSprinklers manages the pump, the selection for this setting should be to configure to use valve 8 as a valve.

- Click on the Write EPROM button to save the setup
- Click on the Read EPOM button to confirm the setup

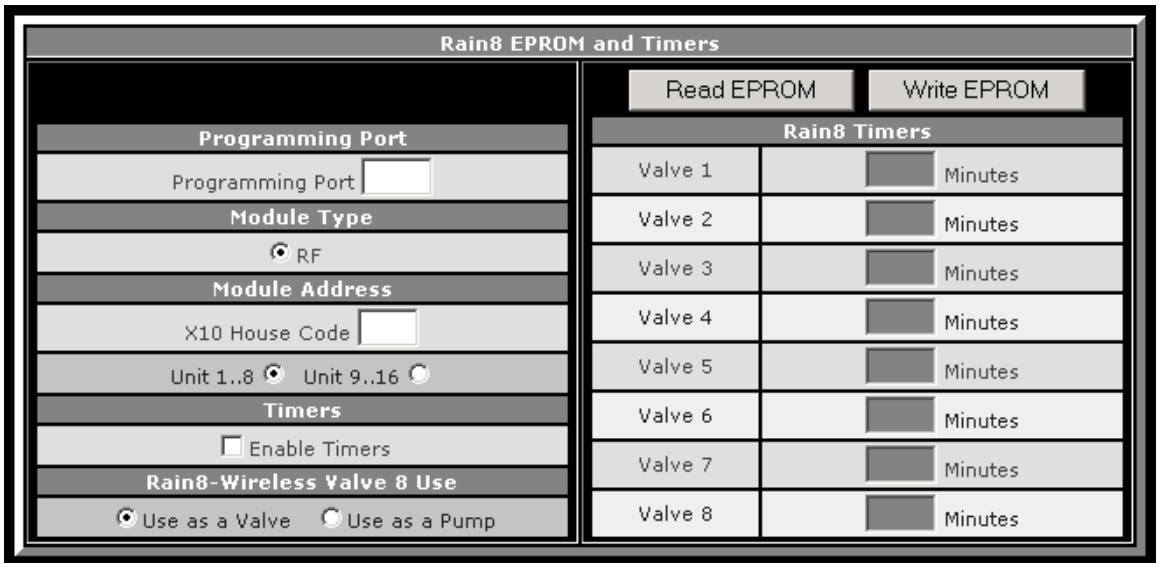


Figure 79 Rain8 Wireless EPROM Setup

12.2.4 Check Out

To test these new settings, **unplug the RS232 cable** and return the Rain8 to its original location. Plug in the terminal and connect the antenna. Verify the 24-vac transformer is plugged in. Connect the antenna coax cable.

Using the settings of the module configured at E1, sending the X10 signal E1-ON with a X10 PalmPad HR12A would cause the valve connected to terminal 1 to open. Sending it an E1-OFF it would close. If nothing were done, it would turn itself off at the end of three minutes. If the EPROM was configured with a different X10 code then selected the one used rather than E1.

12.3 Rain8 X10

The Rain8 is an 8-zone irrigation controller capable of controlling irrigation zones using X10 power line protocol. A CM11A is connected to the PC that host mcsSprinklers to provide the power line commands to the Rain8 X10.

12.3.1 Equipment List

Initial Module

1. Rain8 module
2. 110 to 24-vac, 20VA transformer
3. Modular cable, black
4. RS232 serial cable, DB9 both ends.
5. PSC05 power line interface

Expansion / Slave Module(s)

1. Rain8 module
2. Modular cable, black
3. Modular cable splitter

Interface Components

1. CM11A X10 Power line PC Interface
2. 5 for 1 splitter 80069

12.3.2 Installation

Controller Location

- Select a mounting location that is close to an electrical outlet and the valve wires that will connect to it.
- The controller should not be exposed to water. If used outside, it is necessary to provide a weather proof housing for your Rain8. http://www.wgldesigns.com/r8outdoor.html
- Mount your controller to a smooth dry surface by means of the enclosed Velcro strips.

Wiring the Valves

- If the maximum distance is less then 600 feet, use a single 20 gauge, plastic insulated wire for each valve.
- Each valve has two wires. One wire is designated as the common. All of the common valve wires can be connected together to one wire going to the controller's "common" terminal.
- All connections should be made using wire nuts in grease caps to prevent corrosion.
- Only one valve should be connected to each zone.
- The rated output is 24 VAC at .35 amps (350ma), per zone. Some valves require a greater current then .35 amps to initially open and drop back to a lower value. This will present no problem as long as the drop back value is .35 amps or less.

Connecting the Valve Wires to the Controller

- Determine which valve is to be connected to each zone. Insert each valve wire into its respective position on the terminal strip and gently tighten the setscrew.

- Connect the common wire from the valves to the terminal labeled “common”.

Connecting the Transformer & Interface

- Locate the two terminals labeled 24-vac on the Rain8 module and connect an appropriate length of 18 gauge, 2 conductor zip cord to the transformer screw terminals. The same is done for the 24VAC power connection for all expansion Rain8 units.

Warning!

Make sure that 24VAC terminal 11 on one unit connects to terminal 11 on the next and 24VAC terminal 12 to 12 in a similar manner. Your Rain8 modules and transformer will be damaged if the wires connecting between units are reversed.

- Connect the Rain8 to a PSC05 power line interface using only the WGL furnished black modular cable. An alternate power line interface, the Smarthome powerlinc 1132B, can be used rather than the PSC05. In this case, connect it to the Rain8 module **using only the RJ11 to RJ45 (wide plug) cable that came with the 1132B**.

- Up to 5 Rain8 modules may share a single power line interface.
-

PSC05 interface

- A 2 for 1 splitter is provided in this package for two Rain8s sharing one Interface for 16-zone operation. PSC05 or TW523 only.

- A 5 for 1 splitter (item 80069) is available for installations of up to 40 zones.

Powerlinc 1132B interface

- A 5 for 1 splitter (item 80071) is available for PowerLinc installations of up to 40 zones.

- Use the enclosed black modular cable to connect from the splitter to each Rain8 module.

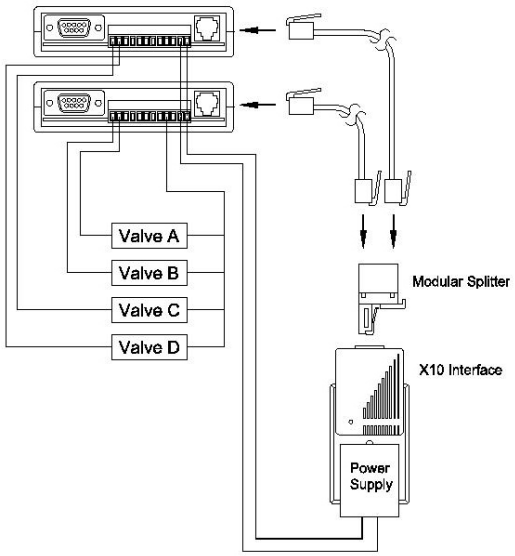


Figure 80 Rain8 X10 Power line and Valve Connections

Prepare to Program the Rain8 module

- Please note that the Rain8 terminal strip is removable. Gently unplug the portion with screw heads from the socket mounted on the PCB. Remove the Rain8 from the wall and bring it to the location of the PC that will be used for programming.

- Connect the DB-9 connector on the Rain8 to a serial cable, with the other end plugged into a serial port on your PC. It is not necessary to provide power for the unit as it can derive what it needs for programming from the serial port.

12.3.3 EPROM Programming for use with mcsSprinklers

Setup of the Rain8 EPROM is done from the Rain8 Setup page of mcsSprinklers. Figure 81 shows the setup parameters that are available. It can also be done with a Rain8Cfg.exe utility that is available from http://wgldesigns.com.

- At this point there is no need for anything to be connected to the Rain8 other than the serial cable. The power for the unit is derived from the serial port.

- Select the PC serial port that is connected to the Rain8

- Select desired address for this module. Each module that is programmed must have a unique address. The address consists of an X10 House code in the range “A” through “P” and one of two banks of eight unit codes.

- Select the Enable Rain8 Timers checkbox so the Rain8 will turnoff each zone as a safety precaution

- Enter the timeout amount for each of the 8 valves. This value will be a few minutes longer than the longest that a zone will be run at any one time

- Click on the Write EPROM button to save the setup
- Click on the Read EPOM button to confirm the setup

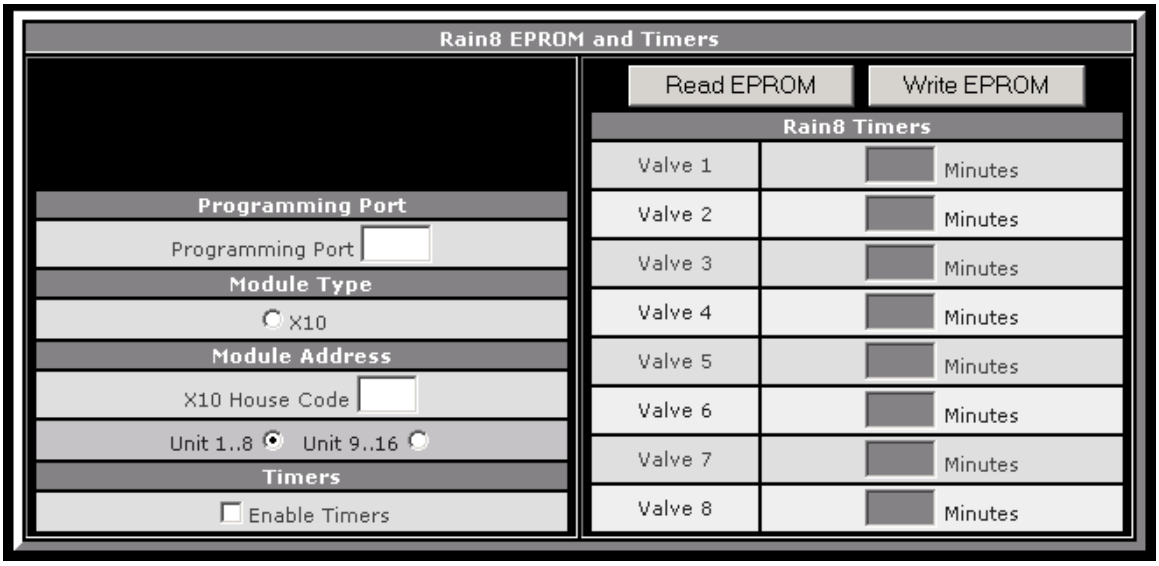


Figure 81 Rain8X10 EPROM Setup

12.4 Rain8 X10 II

The Rain8II is an 8-zone irrigation controller that responds to ON and OFF X10 commands that are unique to each zone. This product supports the standard X10 Status Request codes for true 2-way operation. A CM11A is connected to the PC that host mcsSprinklers to provide the power line commands to the Rain8 X10 II.

12.4.1 Equipment List

Initial Module

1. Rain8II module
2. 110 to 24-vac, 20VA, wall-mounted transformer
3. Black modular cable
4. RS232 serial cable, DB9 both ends.
5. PSC05 Power line interface

Expansion Module(s)

1. Rain8II module
2. Black modular cable
3. Modular cable splitter

Other Interface Components

1. CM11A PC Power line Interface
2. 5 for 1 splitter 80069

12.4.2 Installation

Controller Location

- Select a mounting location that is close to an electrical outlet and the valve wires that will connect to it.
- The controller should not be exposed to water. If used outside, it is necessary to provide a weather proof housing for your Rain8. http://www.wgldesigns.com/r8outdoor.html
- Mount your controller to a smooth dry surface by means of the enclosed Velcro strips.

Wiring the Valves

- If the maximum distance is less then 600 feet, use a single 20 gauge, plastic insulated wire for each valve.
- Each valve has two wires. One wire is designated as the common. All of the common valve wires can be connected together to one wire going to the controller.
- All connections should be made using wire nuts in grease caps to prevent corrosion.
- Only one valve should be connected to each zone.
- The rated output is 24 VAC at .25 amps (250ma), per zone. Some valves require a greater current then .25 amps to initially open and drop back to a lower value. This will present no problem as long as the drop back value is .25 amps or less.

Connecting the Valve Wires to the Controller

- Determine which valve is to be connected to each zone. Insert each valve wire into its respective position on the terminal strip and gently tighten the setscrew.

- Connect the common wire from the valves to the terminal labeled “common”.

Connecting the Transformer & Interface

- Locate the two terminals labeled 24-vac on the Rain8 module and connect an appropriate length of 18 gauge, 2 conductor zip cord to the transformer screw terminals. The same is done for the 24VAC power connection for all expansion Rain8 units.

Warning!

Make sure that 24VAC terminal 11 on one unit connects to terminal 11 on the next and 24VAC terminal 12 to 12 in a similar manner. Your Rain8 modules and transformer will be damaged if the wires connecting between units are reversed.

- Connect the Rain8 to a PSC05 power line interface using only the WGL furnished black modular cable. An alternate power line interface, the Smarthome powerlinc 1132B, can be used rather than the PSC05. In this case, connect it to the Rain8 module **using only the RJ11 to RJ45 (wide plug) cable that came with the 1132B**.

- Up to 5 Rain8 modules may share a single power line interface.
-

PSC05 interface

- A 2 for 1 splitter is provided in this package for two Rain8s sharing one Interface for 16-zone operation. PSC05 or TW523 only.

- A 5 for 1 splitter (item 80069) is available for installations of up to 40 zones.

Powerlinc 1132B interface

- A 5 for 1 splitter (item 80071) is available for PowerLinc installations of up to 40 zones.

- Use the enclosed black modular cable to connect from the splitter to each Rain8 module.

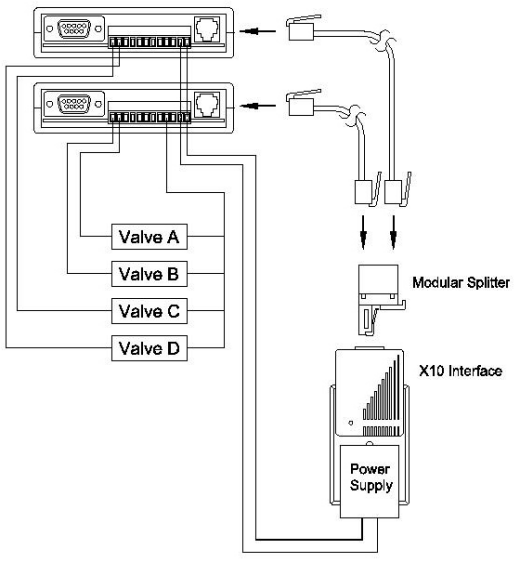


Figure 82 Rain8 X10 II Power line and Valve Connections

Prepare to Program the Rain8 module

- Please note that the Rain8 terminal strip is removable. Gently unplug the portion with screw heads from the socket mounted on the PCB. Remove the Rain8 from the wall and bring it to the location of the PC that will be used for programming.

- Connect the DB-9 connector on the Rain8 to a serial cable, with the other end plugged into a serial port on your PC. It is not necessary to provide power for the unit as it can derive what it needs for programming from the serial port.

12.4.3 EPROM Programming for use with mcsSprinklers

Setup of the Rain8 EPROM is done from the Rain8 Setup page of mcsSprinklers. Figure 83 shows the setup parameters that are available. It can also be done with a Rain8Cfg.exe utility that is available from http://wgldesigns.com.

- At this point there is no need for anything to be connected to the Rain8 other than the serial cable. The power for the unit is derived from the serial port.

- Select the PC serial port that is connected to the Rain8

- Select desired address for this module. Each module that is programmed must have a unique address. The address consists of an X10 House code in the range "A" through "P" and one of two banks of eight unit codes.

- Select the Enable Rain8 Timers checkbox so the Rain8 will turnoff each zone as a safety precaution.

- Enter the timeout amount for each of the 8 valves. This value will be a few minutes longer than the longest that a zone will be run at any one time

- The Rain8 X10 II is a two way X10 device that is able to provide its status immediately after a command is received or provide its status only when explicitly polled for a status response. When using mcsSprinklers as the only X10 controller then the configuration of "Ack on Cmd and Poll" will provide the most efficient user of the power line bandwidth. The "Ack on Poll Only" can be used in all cases where compatibility with other X10 controllers is a concern.

- Click on the Write EPROM button to save the setup

- Click on the Read EPOM button to confirm the setup

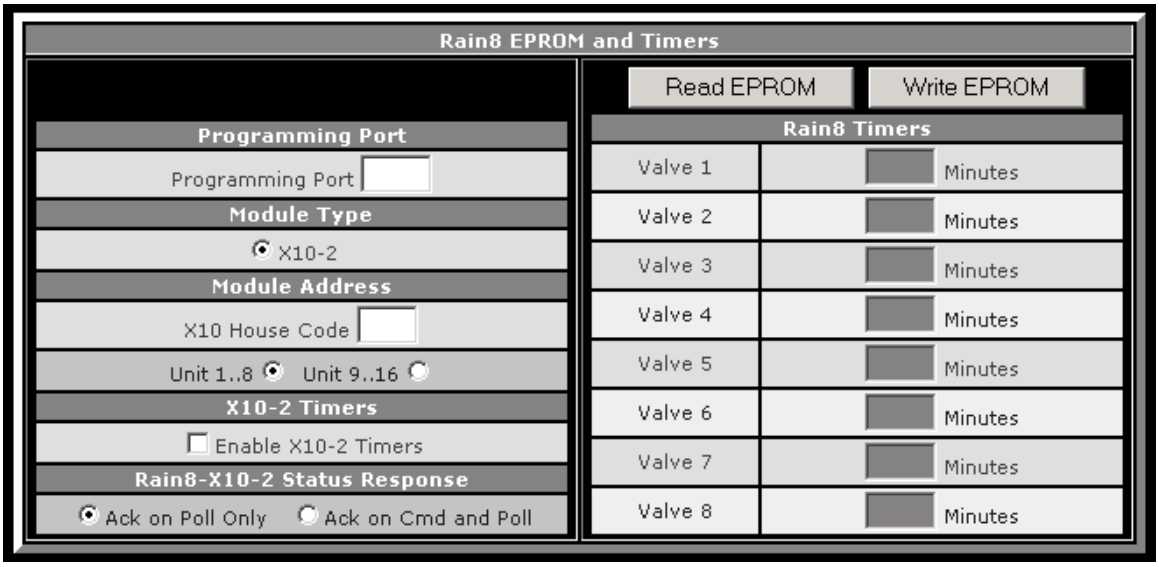


Figure 83 Rain8 X10 II EPROM Setup

12.4.4 Troubleshooting with the Status LED

This Rain8 features a status LED visible from the bottom on the module just the left of the RJ11 interface jack.

No LED

The Rain8 is not running. Verify 24VAC transformer is connected to the last two terminals on the detachable terminal strip.

Steady LED

Everything is working okay. No incoming X10 commands.

Regular flashing LED

No power line interface detected. Check modular cable and verify correct type. Verify interface plugged in to outlet and connected to Rain8.

If is still flashing try replacing cable or interface module.

Intermittent flashing LED, 1 – 2 seconds OFF

Normal operation.

Incoming X10 command detected with a house code and unit code that is enabled. The specified zone will now have 24VAC between in and the common terminal(s).

Intermittent flashing LED, very short OFF

Incoming X10 signal detected with house & unit codes that are **not** enabled. No zones will be active. Verify Rain8 configuration matches transmitted X10 address.

12.5 Rain8 UPB

The Rain8upb is a modular 8-zone sprinkler controller module that is driven by a UPB power line interface (PIM). It is configured as either a master or expansion unit. The difference being that only the master is connected to the PIM and 24VAC transformer.

A system UPB configuration consists of a UPB PIM connected to the PC running mcsSprinklers, a UPB PIM connected to the master Rain8 UPB module, 24VAC transformer connected to the master Rain8 UPB module, optional expansion modules that are connected with daisy chained RJ45 wiring.

12.5.1 Equipment List

Initial Module

1. Rain8upb master module
2. 110 to 24-vac, 20VA, transformer
3. 3 piece RJ11 – DB9 cable assembly

Expansion / Slave Module(s)

1. Rain8upb controller with detachable terminal block in place.
2. Network cable, item 10004

Interface Components

1. Rain8 Master UPB power line interface (PIM).
2. PC UPB power line interface (PIM)
   (PCS PIM-R, Simply Automated UMC-DB9 or HAI 36A00-1)

12.5.2 Installation

Controller Location

- Select a mounting location that is close to an electrical outlet and the valve wires that will connect to it.
- The controller should not be exposed to water. If used outside, it is necessary to provide a weather proof housing for your Rain8. http://www.wgldesigns.com/r8outdoor.html
- Mount your controller to a smooth dry surface by means of the enclosed Velcro strips.

Wiring the Valves

- If the maximum distance is less than 600 feet, use a single 20 gauge, plastic insulated wire for each valve.
- Each valve has two wires. One wire is designated as the common. All of the common valve wires can be connected together to one wire going to the controller.
- All connections should be made using wire nuts in grease caps to prevent corrosion.
- Only one valve should be connected to each zone.
- The rated output is 24 VAC at .35 amps (350ma), per zone. Some valves require a greater current then .35 amps to initially open and drop back to a lower value. This will present no problem as long as the drop back value is .35 amps or less.

Connecting the Valve Wires to the Controller

- Determine which valve is to be connected to each zone. Insert each valve wire into its respective position on the terminal strip and gently tighten the setscrew.

- Connect the common wire from the valves to the terminal labeled “com”.

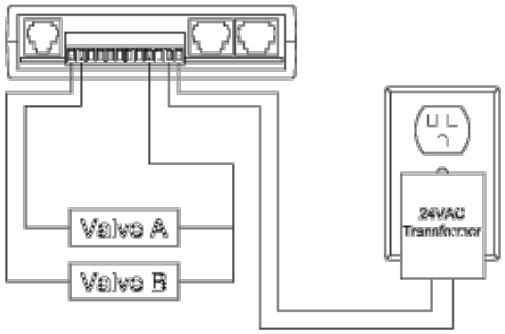


Figure 84 UPB Rain8 Valve and 24VAC Connections

Connecting the Counter/Switch Wires to the Controller

- Connect the rain sensor or flow meter to terminals identified as “input” and second “24VAC”(#12).

Connecting the Transformer (Master unit only)

Connect the 24-VAC transformer to the two terminals labeled “24 VAC”. Note that this is required only on the first module installed as the power for additional units is supplied by means of the network connections.

Connecting the UPB PIM (Master unit only)

There are two techniques for connecting the UPB PIM to the RJ11 jack on your Rain8 module depending on which manufacturers PIM you are using

1. The HAI PIM connects directly to the Rain8 using the 6-conductor modular cable that came with your Rain8upb. Do not use the cable that came with your HAI PIM.

   OR

2. The PCS & Simply Automated PIMs have female DB9 jacks so it is necessary to use the enclosed DB9 – RJ11 adapter and the M-M gender changer in addition to the modular cable.

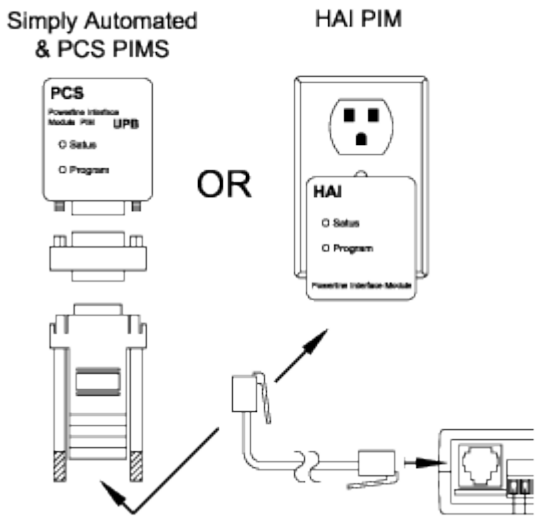


Figure 85 UPB PIM Connection to Rain8

Congratulations you are now ready to apply power. The first thing you should see is the green LED blinking. This indicates the Rain8upb is looking for a PIM. When it finds one, the LED stops blinking and stays on steady. This normally just takes a few seconds.

Prepare to Program the Rain8 module

- Using the RJ11 cable and the DB9 adapter (but not the gender changer), connect DB9 end to a COM port or USB adapter on your PC. Connect the RJ11 end to the jack labeled "PIM-config"" on the left.

- It is not necessary to provide 24VAC power at this point as it is supplied over the RS232 link. The green LED to the left of the RJ45 jacks should be off.

12.5.3 EPROM Programming for use with mcsSprinklers

Setup of the Rain8 EPROM is done from the Rain8 Setup page of mcsSprinklers. Figure 83 shows the setup parameters that are available. It can also be done with a Rain8Cfg.exe utility that is available from http://wgldesigns.com.

- At this point there is no need for anything to be connected to the Rain8 other than the serial cable. The power for the unit is derived from the serial port.

- Select the PC serial port that is connected to the Rain8

- Select desired address for this module. There are two part to the UPB address. One is the network address (NID) and the second is the device ID (DID). These are selected based upon compatibility with other UPB components installed at the site. If no others are installed then values of 1 for the NID will be fine. It will also need to be configured in the UPB Processor Interface Module (PIM) for network compatibility.

- The module ID will need to be unique for each Rain8 module. Each module maps into 8 UPD DID's. For use of UPB DID's 1 through 8, a value of 1 would be entered into the Module ID setup field to indicate that this UPB Rain8 Module #1. If the value of 2 is entered for the DID, then the UPB DID's

to which the module will respond will be 9 through 16. The same relationship exists for modules 3 and above.

- Select the Enable Rain8 Timers checkbox so the Rain8 will turnoff each zone as a safety precaution.
- Enter the timeout amount for each of the 8 valves. This value will be a few minutes longer than the longest that a zone will be run at any one time
- The timer resolution expected by mcsSprinklers is in Minutes so that selection should be made at the radio button.
- mcsSprinklers will support either a counter input for water use measurement or a switch input for an inhibit. Select the radio for how it will be used in this application. If input is not used then select the unused radio position. The input data will be presented on a UPB DID that is entered on the input. This is a single DID and not a Rain8 Module ID that is used for the output control. If the counter input data is to be delivered when UPB DID 99 is queried, t hen a value of 99 would be entered on the setup. The same is true for any other input UPB DID
- Click on the Write EPROM button to save the setup
- Click on the Read EPOM button to confirm the setup

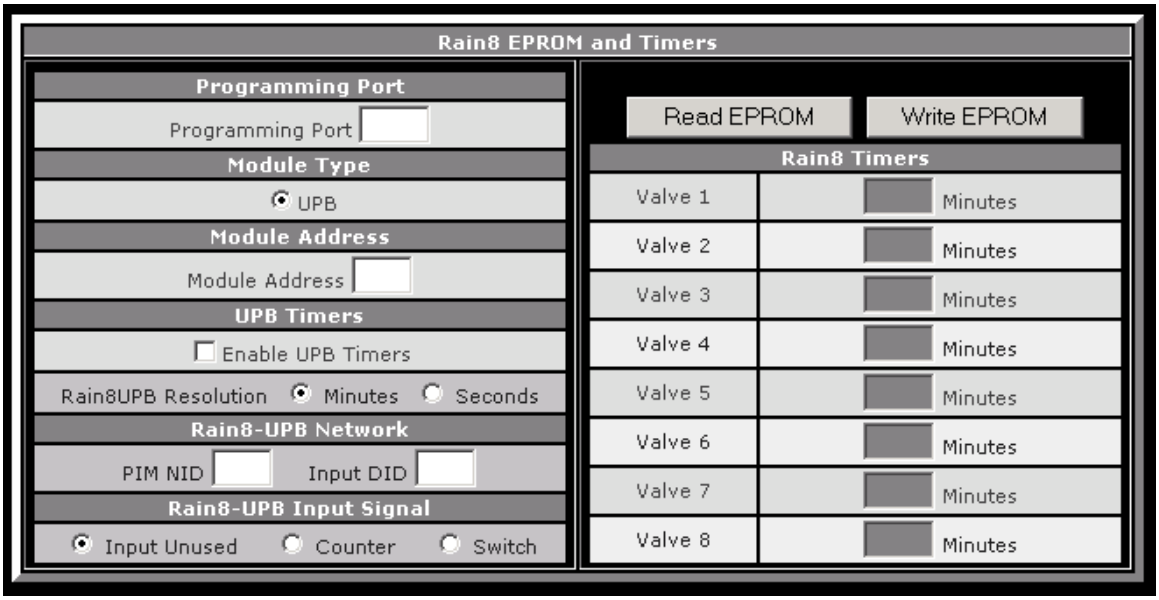


Figure 86 Rain8 UPB EPROM Setup

12.5.4 The Rain8UPB and UPStart

In the UPB world everything is setup with UPStart. The export from UPStart is used as the input when other automation is integrated with UPB. Unfortunately UPStart does not see the Rain8UPB as a standard UPB module. The solution is to create 8 UPB Appliance modules with their DID's mapped into the 8 Rain8 DIDs to become "place holders" for the Rain8UPBs.

To installer must enter the module numbers that were previously programmed into the Rain8UPB. For example you have one Rain8UPB module and it is configured to be module ID #3, the actual UPB device ID's will be 17 through 24 for these 8 valves. As the user/installer you need to select module ID's that will result in Device IDs that are not already being used by UPStart.

If what you have selected overlaps with your existing UPB network then you will need to reprogram the Rain8UPB to find an unused sequence of UPB DID's. It also means that in the future when you add other UPB modules you will not want to add these at the same device address as the Rain8UPBs.

12.5.5 Troubleshooting with the Status LED

This Rain8 features a status LED visible from the bottom on the module just the left of the RJ45 network jacks.

No LED
The Rain8 is not running. Verify 24VAC transformer is connected to the last two terminals.

Steady LED
Everything is working okay. No incoming commands.

Regular flashing LED
No PIM detected. Check modular cable and verify correct type. Verify interface plugged in to outlet and connected to Rain8.

Intermittent flashing LED, 1 – 2 seconds OFF
Normal operation to turn on or off a zone.
Incoming command detected with a NID code and DID code that is enabled. The specified zone will now have 24VAC between in and the common terminal(s).

Intermittent flashing LED, very short OFF
Incoming UPB signal detected with NID or DID codes that are **not** enabled. No zones will be active.

Checking it out

Checkout can be done after setup of the Rain8UPB within mcsSprinklers by running the Communication test. It can also be setup with a test application that is available from http://wgldesigns.com/rain8upb.html This program runs on a PC and requires a second PIM to communicate with the power line and present UPB signals to your Rain8UPB.

1. Verify your Rain8upb's green LED is on steady.

2. Select the COM port number your second PIM is connected to and click "connect".

3. Enter the NID that was configured earlier.

4. Enter the assigned rain8 module number.

5. Click on the key that represents the zone you wish to activate.

6. Click on "send on cmd" and specified zone should now have 24VAC between its terminal and common (COM).

7. If the "auto query" is enabled, an automatic status request is transmitted each time a command is sent. The results of the query are a sold green circle if the zone is active and a checkered one if it is off. A gray circle indicates no response from the query. Possibly due to no matching NID or DID. The query command can also be sent manually by clicking its button.

13 RS-232 Adapters

13.1 USB – Serial

USB to RS-232 COM adapters are available at most computer hardware suppliers. Typically the hardware quality is similar for most products, but the software drivers do vary in quality. Products based upon the FTDI chipset have well supported software drivers. Two known products that have had good success are:

Byterunner: http://www.byterunner.com/byterunner/new_frontpage=usbserialadapters

Digi Edgeport: http://www.digi.com/products/usb/edgeport.jsp#overview

IP – Serial

IP to RS-232 adapters have been in use for 20+ years in applications of printer and terminal servers. This means surplus hardware is often available for the wired version of IP to Serial. New technology is in widespread use with many suppliers that have both wired and WiFi versions.

Two primary issue that have been experienced are software drivers and voltage levels. A driver can be used to emulate a COM port such as redirector software from Lantronix. This is needed for the Basic and Standard mcsSprnklers versions. The Professional version is able to communicate directly in IP using a raw (no protocol) mode. The driver problem typically arrises as new operating systems are released and especially for the x64 versions.

The second issue is for voltage level. Many IP/Serial products use TTL (3.5V/0V) rather than RS-232 (12V/-12V). The standard Rain8Net operates at the lower voltage levels, but the Rain8Net PRO does not.

Some suppliers for new products are:

Comtrol DeviceMaster: http://www.comtrol.com/pub/products/category/cid/63

Lantronix: http://www.lantronix.com/device-networking/embedded-device-servers/

Bluetooth – Serial

Bluetooth is a new technology with wireless connectivity that has coverage typical of a home installation. While the advertised range is over 100 ft, it will depend upon installation specifics that allow clear RF transmission.

A supplier which has yielded good results is:

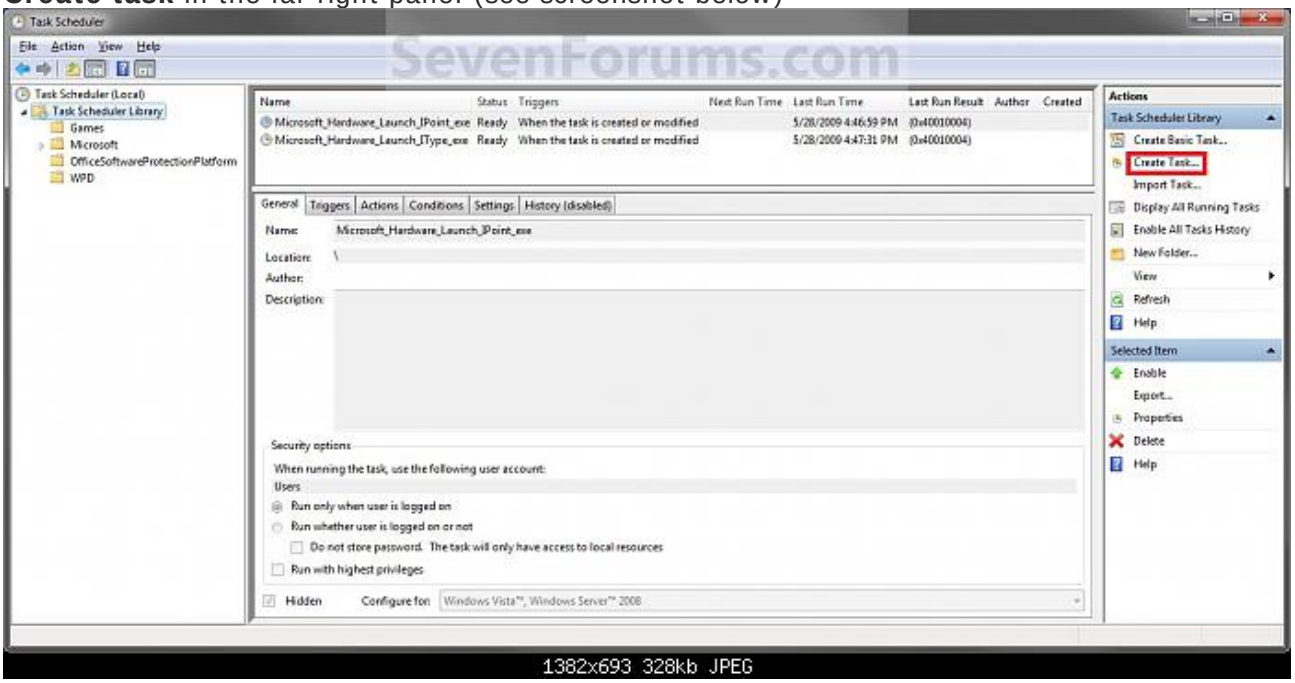
WCSC: http://store.wcscnet.com/cgi/display.cgi?item_num=HDWBTRS232

14 User Access Control and Confirmation Prompts

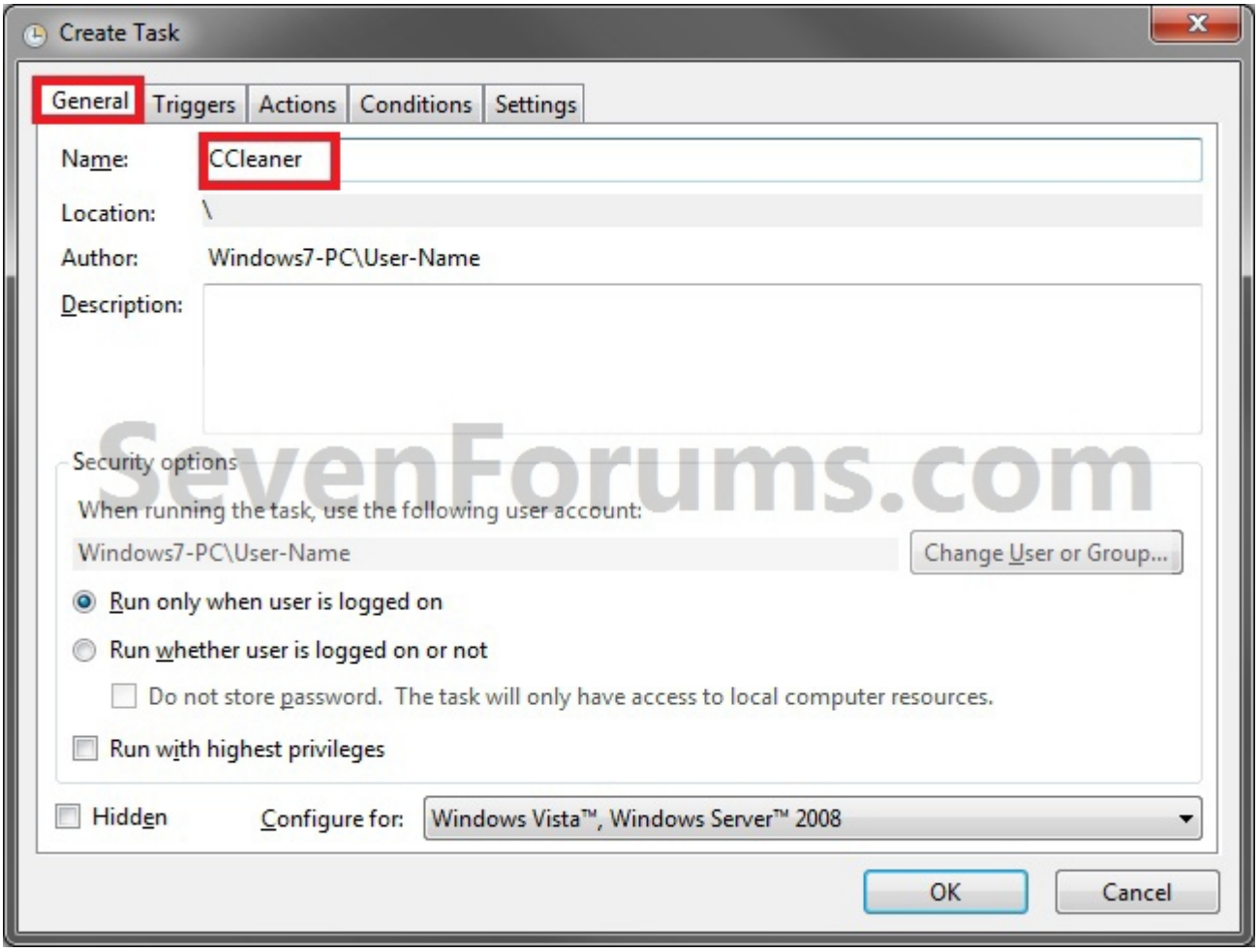
When running on Windows version starting with Vista enhanced security needs to be considered. mcsSprinklers must be “run as administrator” since it communicates with hardware resources. When User Access Control (UAC) is enabled then a user prompt will be presented to confirm startup intent with the additional privileges. This prompt is usually not desirable, especially with unattended restarts. This can be overcome with a shortcut that enables elevated operation. A tutorial is provided at http://www.sevenforums.com/tutorials/11949-elevated-program-shortcut-without-uac-prompt-create.html which is shown in the steps below.

1. Press the Windows + R keys to open the Run dialog, type **taskschd.msc**, and press Enter.
NOTE: *This will open Task Scheduler. This file is located at:*
C:\Windows\system32\taskschd.msc.

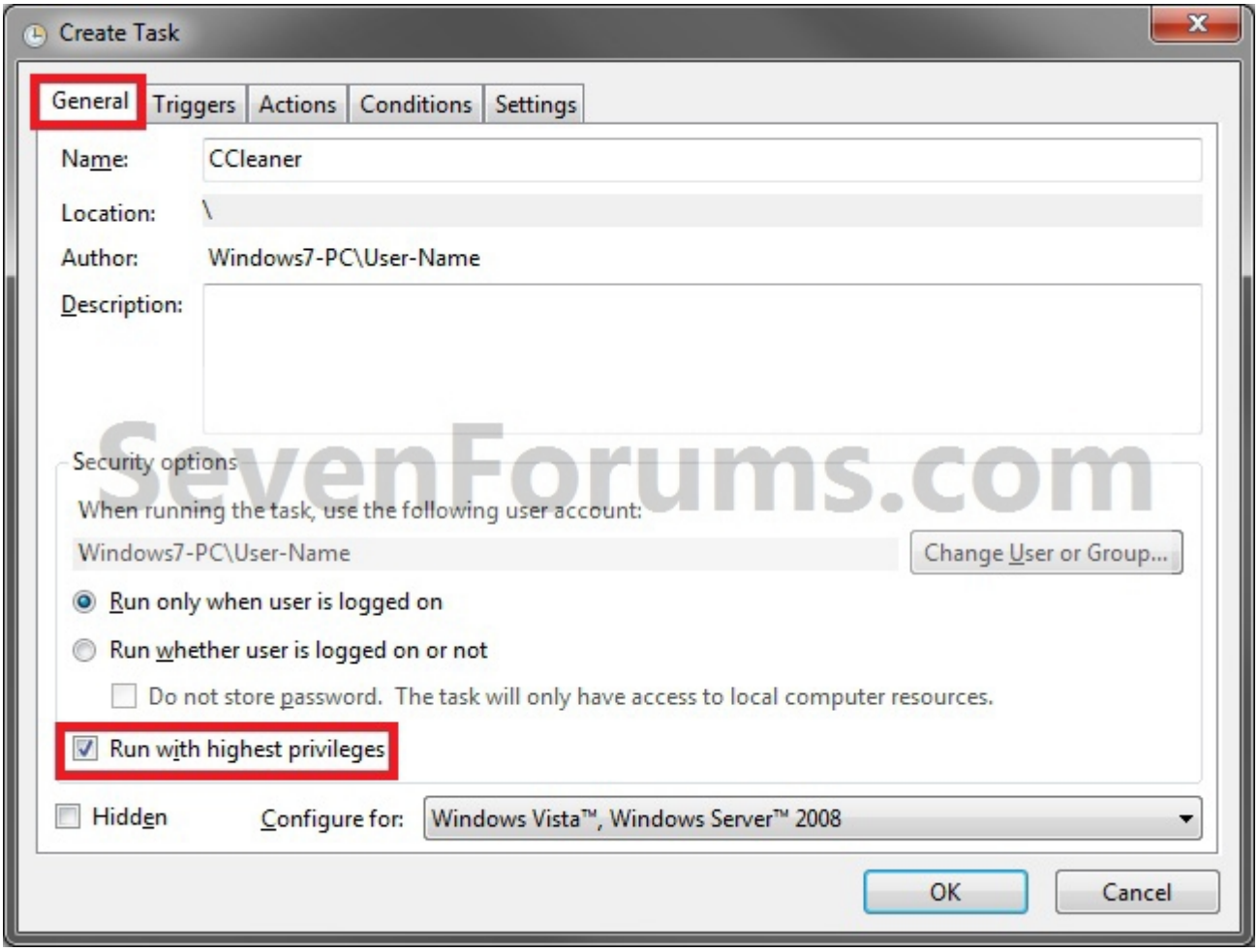
2. While having **Task Scheduler Library** selected in the left pane, click/tap on **Create task** in the far right pane. (see screenshot below)



3. Under the **General** tab, type in the "Name" of the program you want to create this shortcut for. (see screenshot below)
NOTE: *This will be the name of the task. As an example, I will use **CCleaner** for that program. Make note of this name, you will need it later in **step 12 and 14** below.*

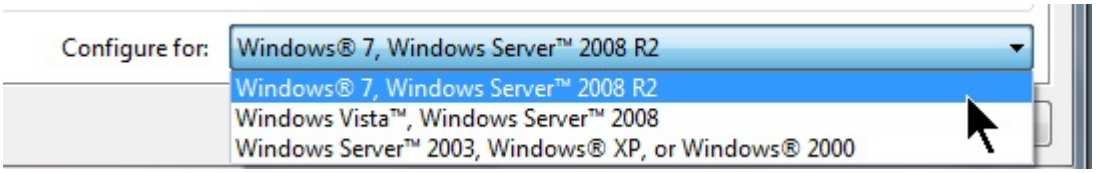


4. Check the **Run with highest privileges** box. (See screenshot below)

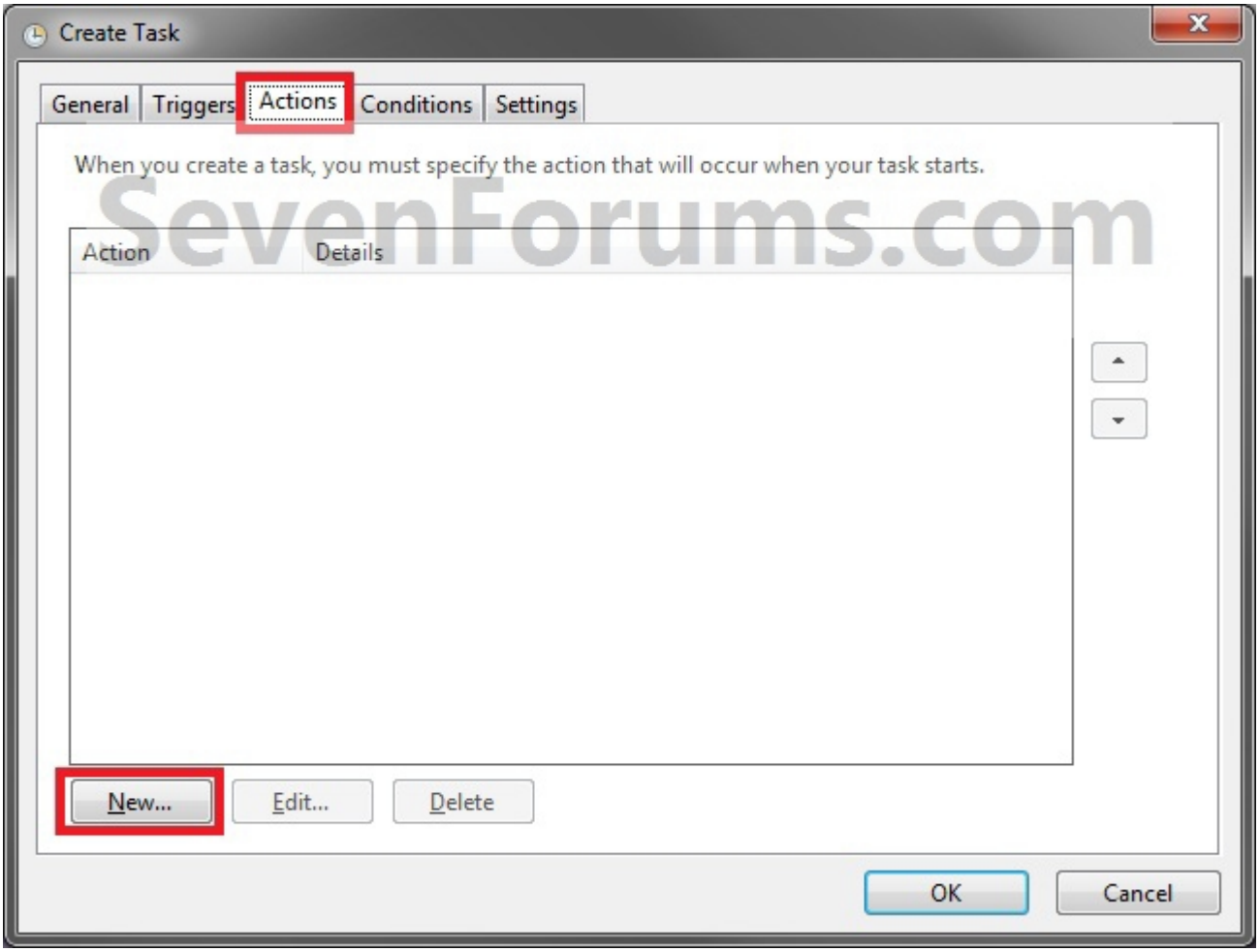


5. Click/tap on the **Configure for** drop down box to open it, and select **Windows® 7, Windows Server™ 2008 R2** or the Windows you are currently in. (see screenshot above and below)

NOTE: *This is like* ***compatibility mode****. If the program does not support running in Windows 7 normally, then you can select the OS that is does support running in instead to have it run in compatibility mode as if it was running in that OS instead of Windows 7.*


Configure for:
Windows® 7, Windows Server™ 2008 R2
Windows® 7, Windows Server™ 2008 R2
Windows Vista™, Windows Server™ 2008
Windows Server™ 2003, Windows® XP, or Windows® 2000

6. Click/tap on the **Actions** tab, then on the **New** button. (see screenshot below)



7. In the **Program / script:** box in the Actions tab, copy and paste the path below. (see screenshot below step 9)
NOTE: *Thank you to **chillz** for the updated steps 7 and 8.*
%windir%\System32\cmd.exe

8. In the **Add arguments (optional):** box in the Actions tab, type in the argument below. (see screenshot below step 9)

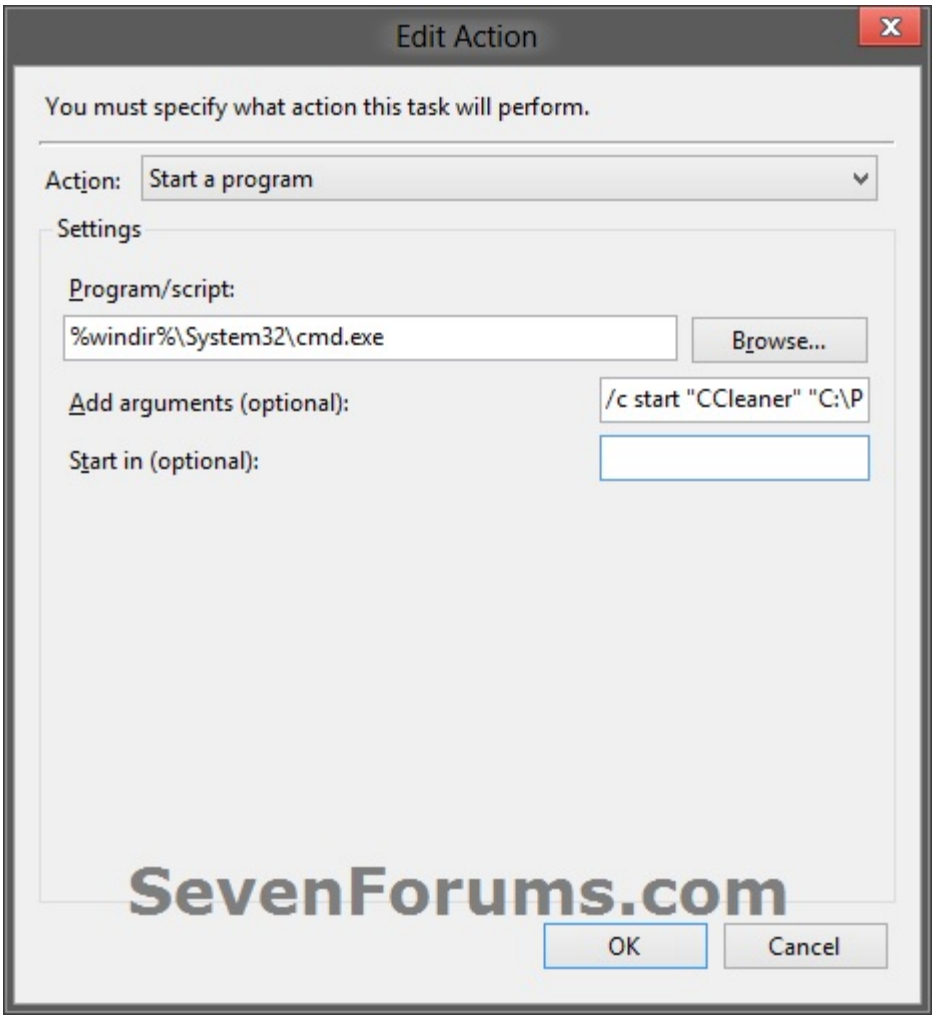
NOTE: *Substitute **Task Name** in the argument below with the name you entered in **step 3** (ex: CCleaner) within quotes, and substitute **Full Path of Program** in the argument below with the actual full path of the program's .exe file within quote.*
/c start "Task Name" "Full Path of Program"

For example:

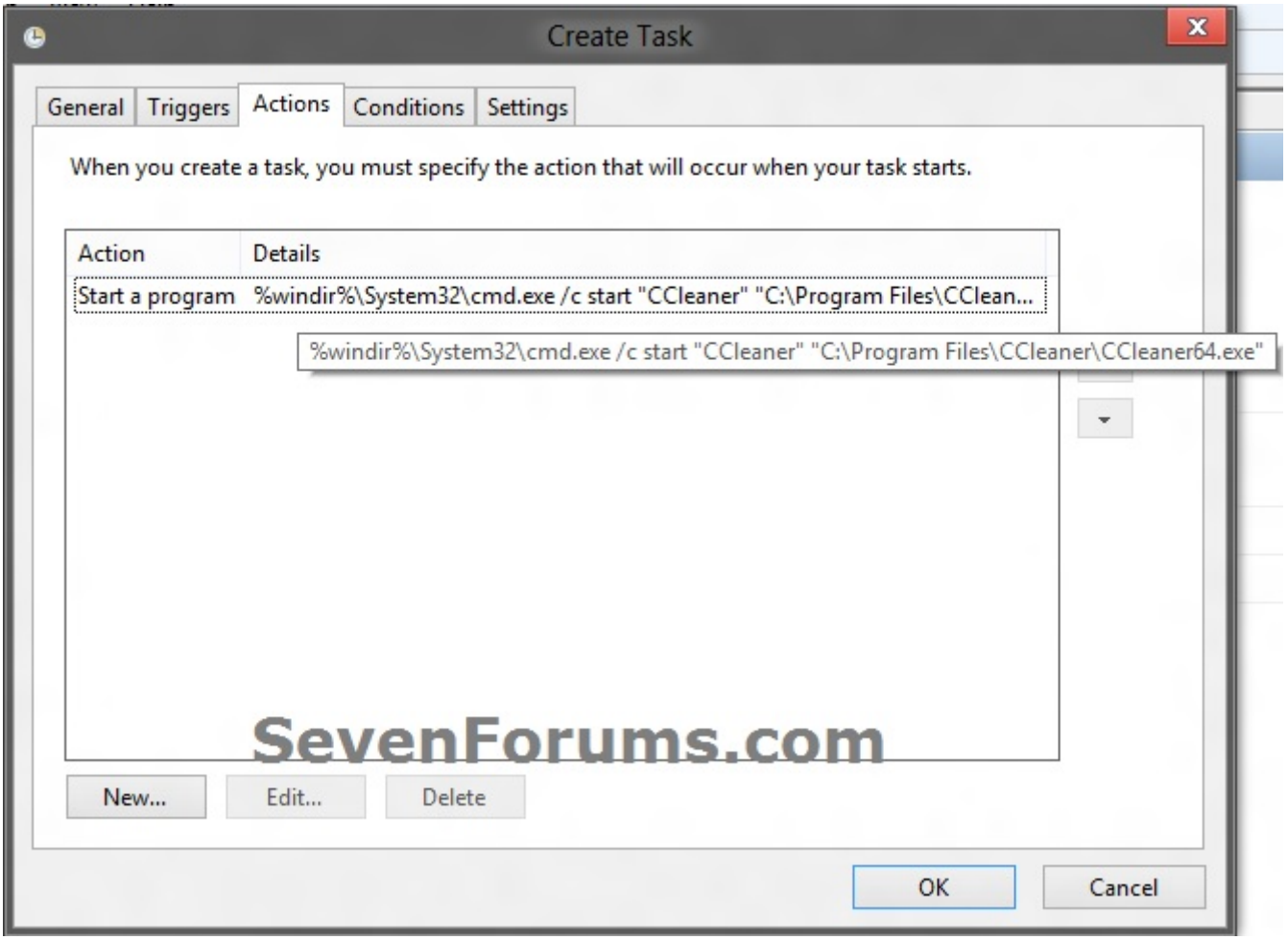
Code:

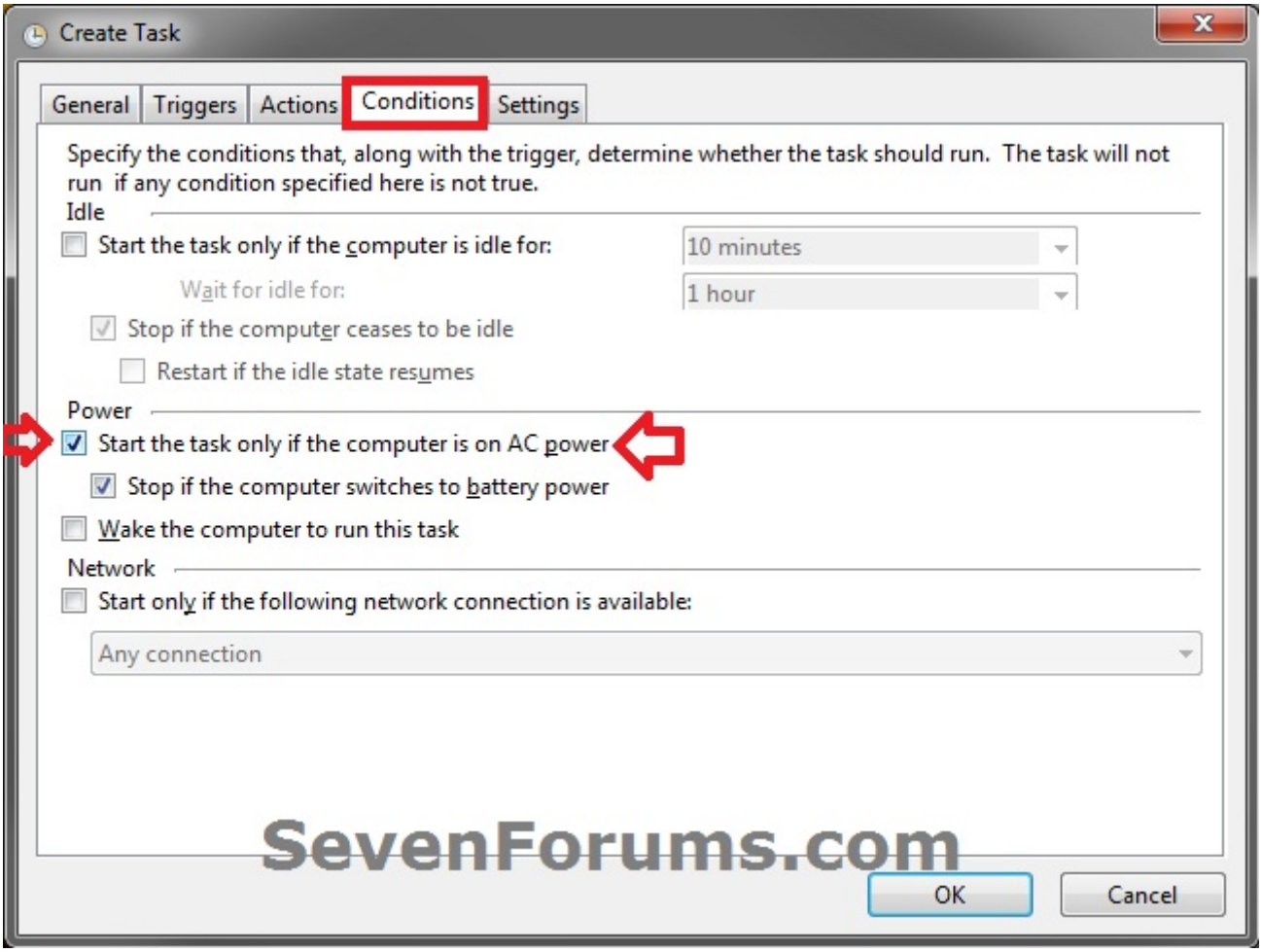
```
/c start "CCleaner" "C:\Program Files\CCleaner\CCleaner64.exe"
```

9. Click/tap on **OK**. (see screenshot below)



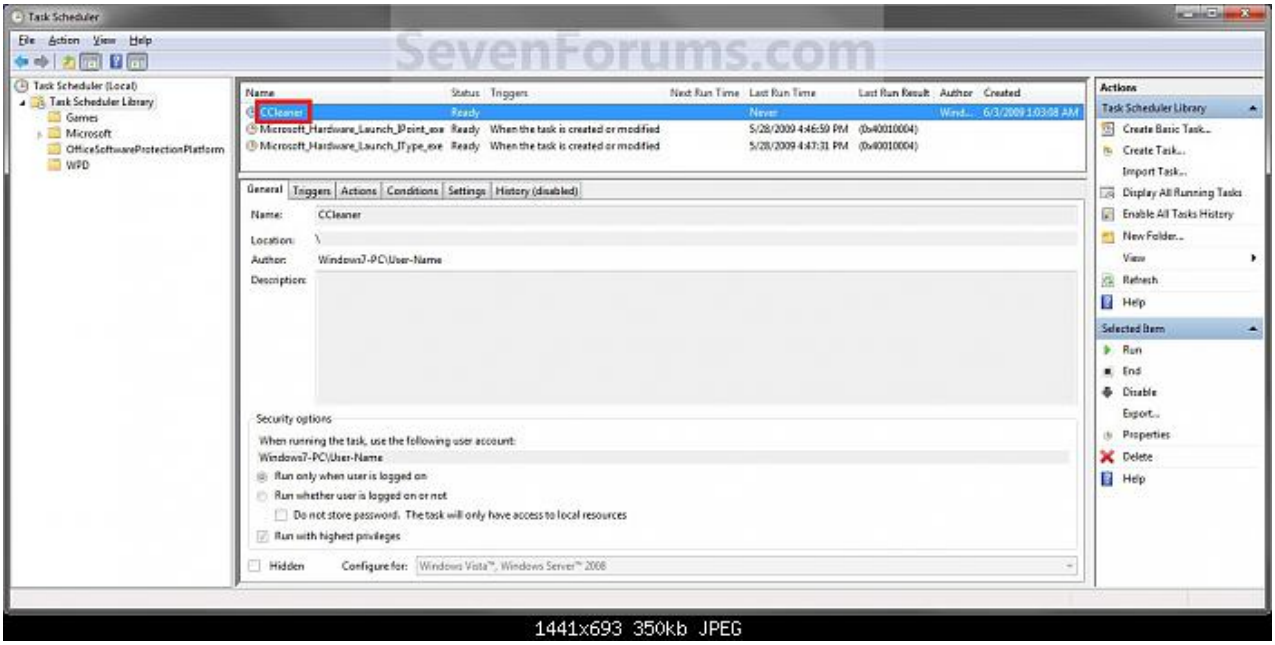
10. Click/tap on the **Conditions** tab, and uncheck the **Stop if the computer switches to battery power** box first, then uncheck the **Start the task only if the computer is on AC power** box. (see screenshots below)
NOTE: *This step is mostly for laptops, so that you will be able to run the program when the laptop is running on battery power*.


Create Task
General
Triggers
Actions
Conditions
Settings
When you create a task, you must specify the action that will occur when your task starts.
Action
Details
Start a program
%windir%\System32\cmd.exe /c start "CCleaner" "C:\Program Files\CClean...
%windir%\System32\cmd.exe /c start "CCleaner" "C:\Program Files\CCleaner\CCleaner64.exe"
SevenForums.com
New...
Edit...
Delete
OK
Cancel


Create Task
General
Triggers
Actions
Conditions
Settings
Specify the conditions that, along with the trigger, determine whether the task should run. The task will not run if any condition specified here is not true.
Idle
Start the task only if the computer is idle for:
10 minutes
Wait for idle for:
1 hour
Stop if the computer ceases to be idle
Restart if the idle state resumes
Power
Start the task only if the computer is on AC power
Stop if the computer switches to battery power
Wake the computer to run this task
Network
Start only if the following network connection is available:
Any connection
SevenForums.com
OK
Cancel

11. Click/tap on **OK**. (See screenshots above)

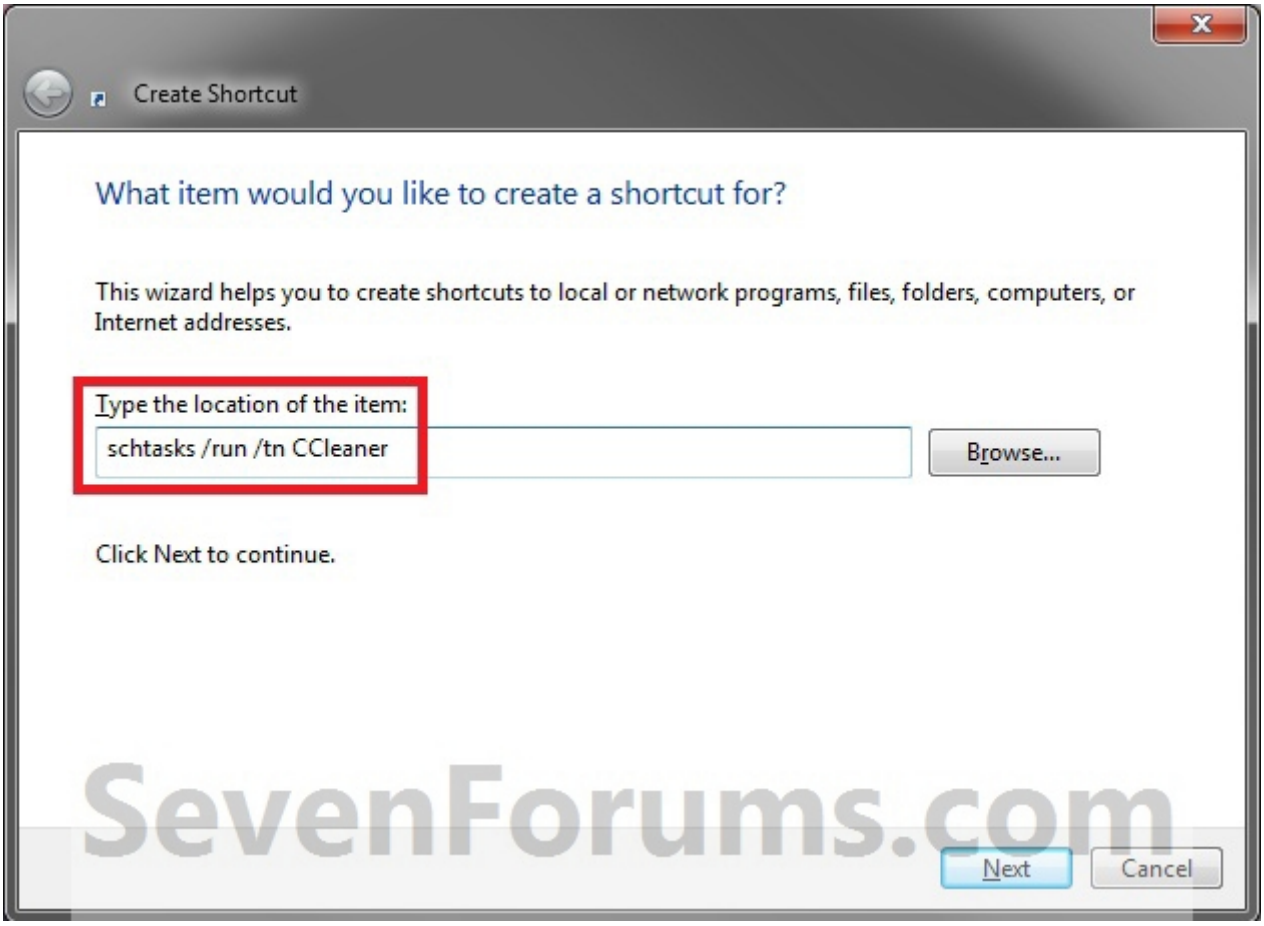
12. You will now see your **new task** created with the name (ex: CCleaner) you gave it in **step 3**. Close Task Scheduler. (see screenshot below)



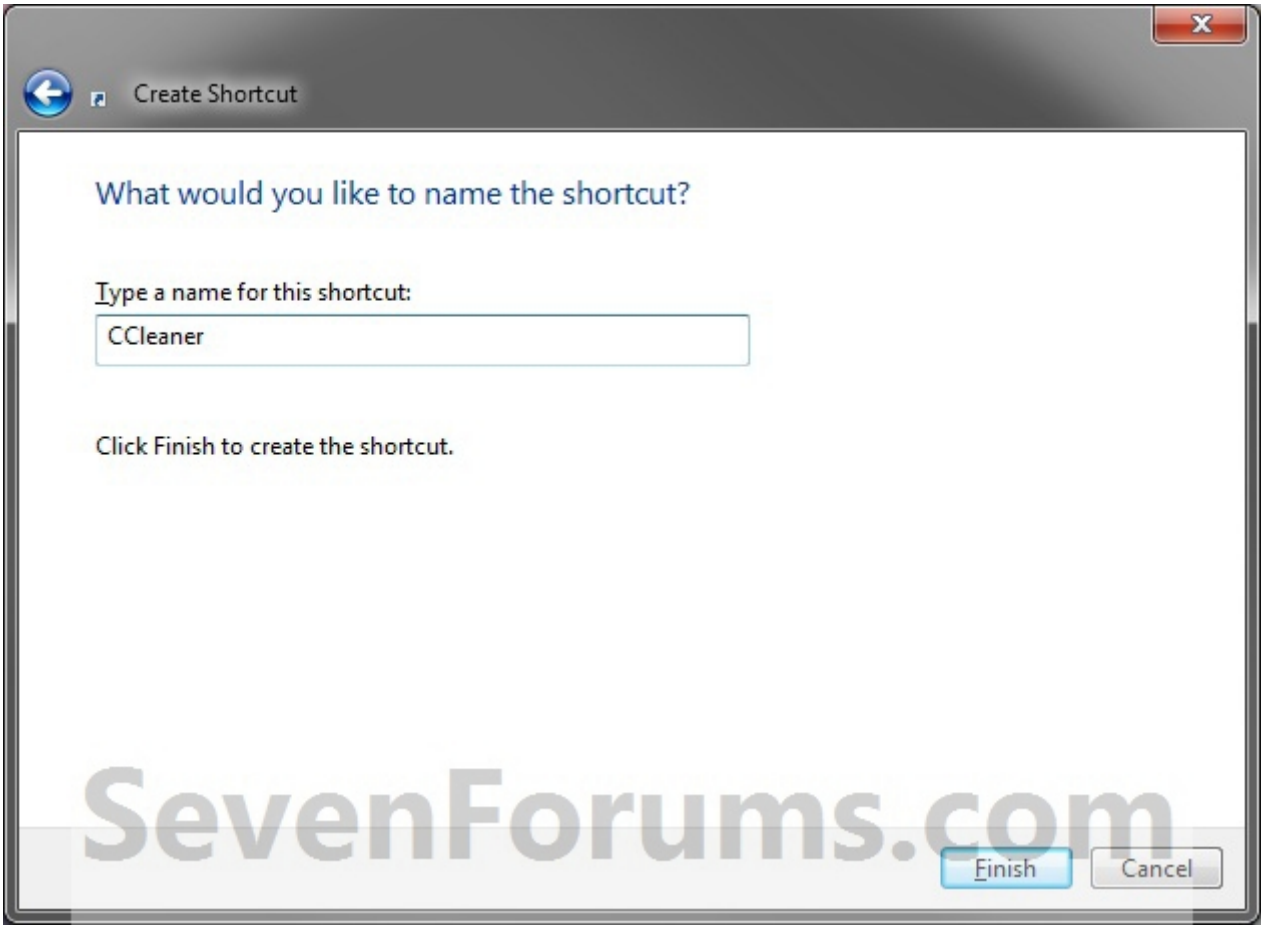
13. Right click or press and hold on an empty area of your desktop, then click/tap on **New** and **Shortcut**.

14. Type in the target below for the location field, then click/tap on the **Next** button. (see screenshot below)
NOTE: *Subsitute **task-name** in the target with the name (ex: CCleaner) within quotes that you used in **step 3**.*
schtasks /run /tn "task-name"

For example: For my task name **CCleaner** I used from step 3, I would type:
schtasks /run /tn "CCleaner"

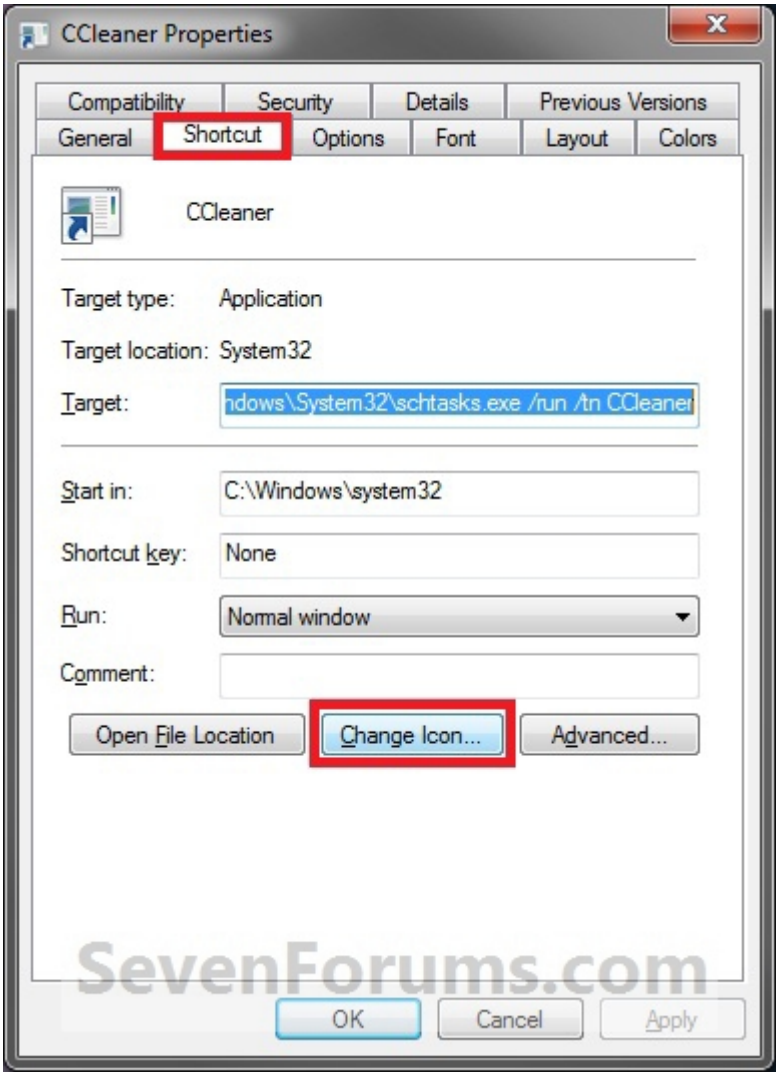

Create Shortcut
What item would you like to create a shortcut for?
This wizard helps you to create shortcuts to local or network programs, files, folders, computers, or Internet addresses.
Type the location of the item:
schtasks /run /tn CCleaner
Browse...
Click Next to continue.
SevenForums.com
Next
Cancel

15. Type in a name you want for the shortcut (ex: CCleaner), then click/tap on the **Finish** button. (see screenshot below)

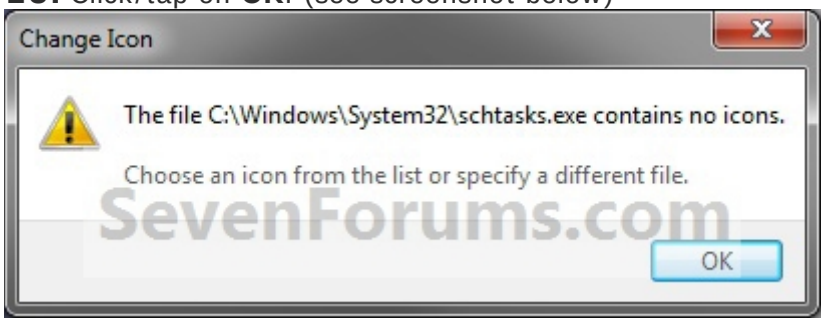


16. Right click on the new shortcut (ex: CCleaner) on the desktop, then click/tap on **Properties**.

17. Click/tap on the **Shortcut** tab, and on the **Change Icon** button. (see screenshot below)

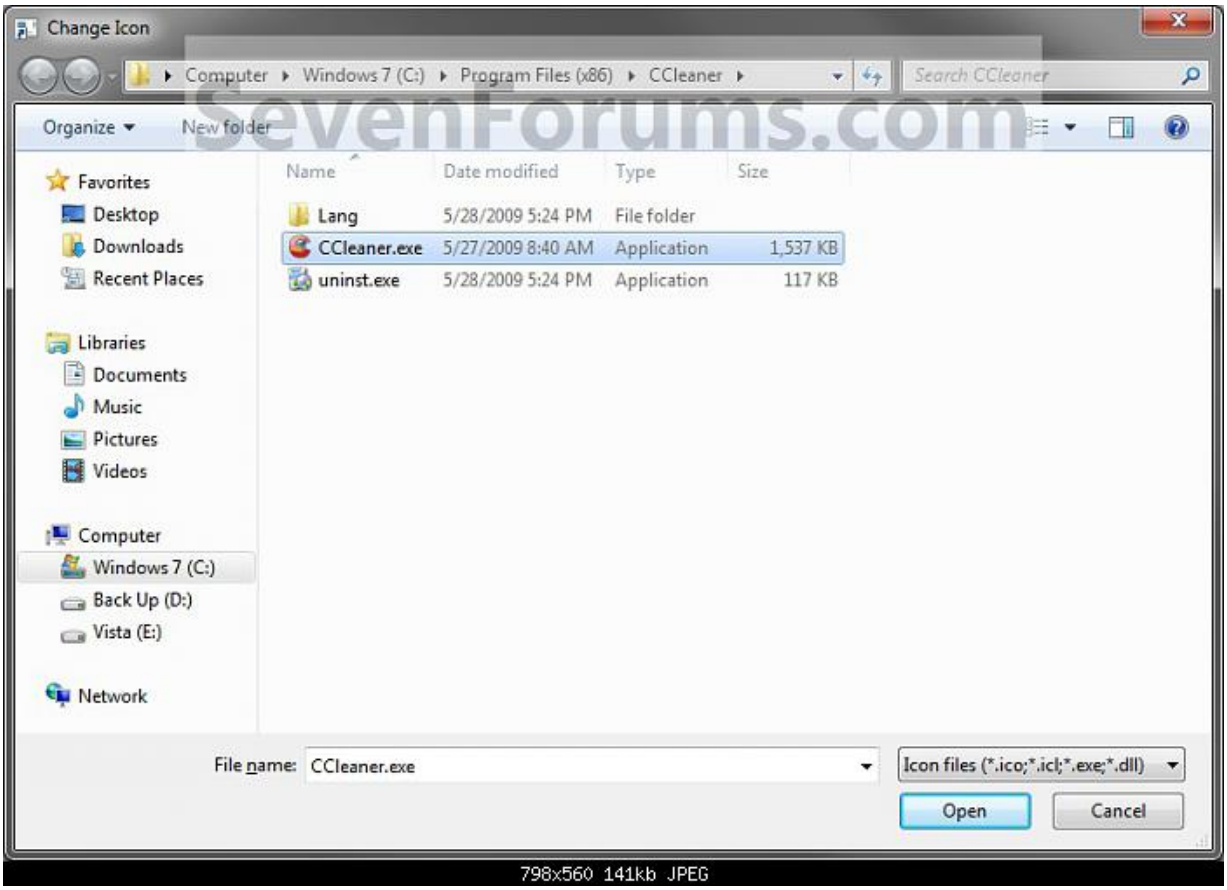


18. Click/tap on **OK**. (see screenshot below)


Change Icon
The file C:\Windows\System32\schtasks.exe contains no icons.
Choose an icon from the list or specify a different file.
SevenForums.com
OK

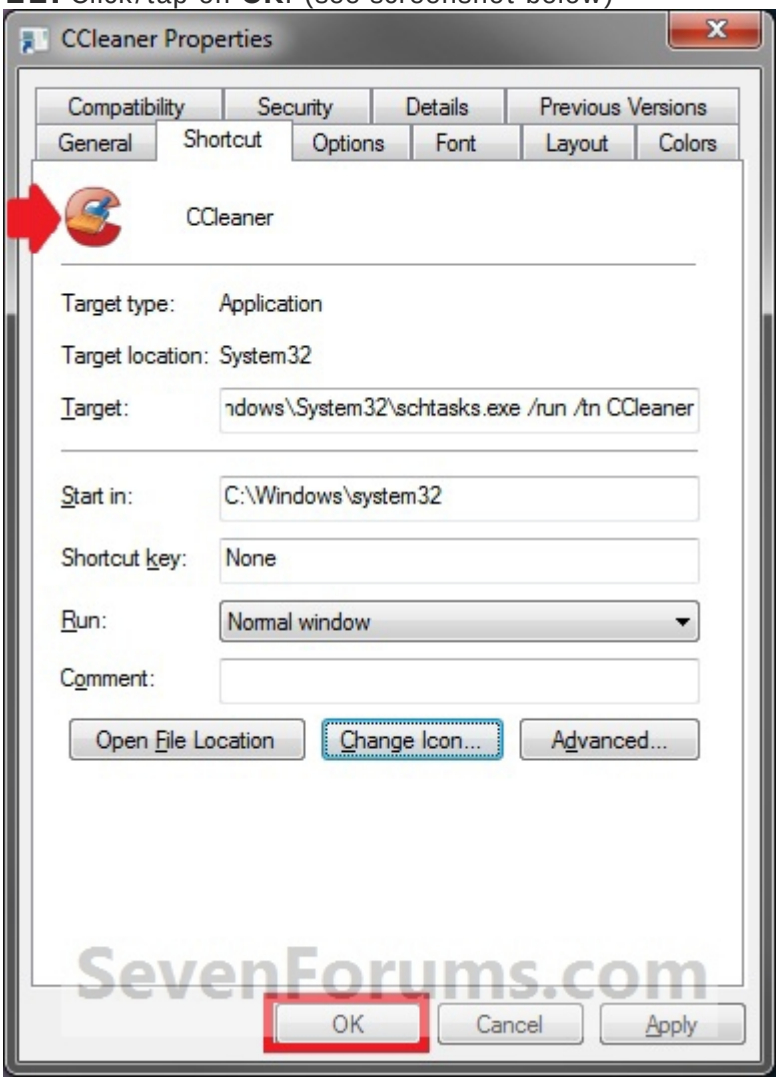
19. Click/tap on the **Browse** button. (see screenshot below)

20. Navigate to the .exe file of the program that you have created this shortcut with, select it, and click/tap on **Open**. (see screenshot below)
NOTE: *If you have a icon of your own that you would prefer to use instead, then navigate to where you have that icon saved at instead.*



21. Select the icon you want for the shortcut, then click/tap on **OK**. (see screenshot below)

22. Click/tap on **OK**. (see screenshot below)



23. You can now use this elevated shortcut to **run at startup in your "Startup" folder**, **run at startup as a task**, **Pin to Start Menu**, **Pin to Taskbar**, **assign a keyboard shortcut**, or move to where you like for easy use.

Note

If you would like to stop the **quick flashing CMD pop-up** when using the shortcut, then you can do this below to do so.

- Right click on the shortcut and click on **Properties**.
- Click on the **Shortcut** tab.
- Select **Minimized** in the drop down menu to the left of **Run**, and click/tap **OK**.

24. When you run this new elevated shortcut, you will now no longer have to click/tap on **YES** to approve the **UAC** prompt to allow the program **run as administrator**.

Tip

To Undo and Remove this Task:

- While having **Task Scheduler Library** selected in the left pane, right click on the task in the right pane that you created in step 12, then click on **Delete** and **Yes** to approve.
- Delete the shortcut.